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Feasibility study on the expansion to phases 2 and 3 of the global record of fishing vessels, refrigerated transport vessels and supply vessels

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SUSTAINABLE FISHERIES MANAGEMENT MASTER
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Trabajo realizado en la sede de Roma de la Organización de Naciones Unidas para la Alimentación y la Agricultura (FAO), Italia, bajo la dirección del Oficial de la FAO; Alicia Mosteiro Cabanelas.

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Abstract

The Global Record of Fishing Vessels, Refrigerated Transport Vessels and Supply Vessels (Global Record) is a phased and collaborative global initiative to make available, in a rapid way, certified data from State authorities about vessels and vessel-related activities. The programme aims towards providing a single access point for information on vessels used for fishing and fishing-related activities with the primary objective being to combat illegal, unreported and unregulated (IUU) fishing by enhancing transparency and traceability.

Given the difficulties that large number of fishing vessels could generate in the usability of the Information System and in the allocation of reliable International Maritime Organization (IMO) numbers to existing fishing vessels, a feasibility study was conducted. This feasibility study aims to identify key criteria and minimum requirements to minimize the number of fishing vessels that will be needed to increase the usability of the system without undermining its main objective of fighting (IUU) fishing by means of enhancing transparency. The main challenges encountered were the important and numerous gaps related with the current global number of fishing vessels which strongly undermines transparency. Several circumstances as the reluctance of some Flag States to report vessel numbers and a high number of Regional Bodies with no harmonization of databases what difficult data aggregation, among others.

Preliminary results emerge that criteria such as vessels fishing activities in High Seas or other Exclusive Economic Zones (EEZs), type of vessel and historical IUU fishing activities reported, could be used to define a minimum length boundary of inclusion. Nevertheless, a complementary study should be realized by the company IHSM&T, in charge of managing the IMO Ship Identification Number Scheme, to determine their issuing capacity to allocate IMO numbers to existing fishing vessels.

Resumen

El Registro mundial de buques de pesca, transporte refrigerado y suministro (Registro mundial) es una iniciativa colaborativa mundial enfocada por etapas, para poner a disposición, de manera sencilla, información certificada proveniente de las autoridades de los estados sobre sus barcos y actividades relacionadas. El proyecto tiene como objetivo proporcionar un único punto de información sobre buques utilizados para la pesca o en actividades pesqueras relacionadas, siendo el principal objetivo combatir la pesca ilegal, no declarada y no regunada (INDNR), mediante el aumento de la transparencia y trazabilidad.

Este estudio de factibilidad tiene lugar, debido a las dificultades que genera una cantidad elevada de buques de pesca en cuanto a la funcionalidad del Sistema de Información, y la asignación de números de la Organización Marítima Internacional (OMI) para los buques pesqueros existentes. El estudio tiene como objetivo identificar criterios clave y requisitos mínimos que permitan minimizar el número de buques de pesca que deben cargarse en el sistema para mejorar su funcionalidad, sin socavar su objetivo principal de lucha contra la pesca INDNR mediante el aumento de la transparencia. Los principales desafíos encontrados a lo largo del estudio se debieron a los importantes y numerosos vacíos de información existentes a nivel global. Algunas circunstancias como la reticencia de ciertos estados de pabellón de informar sobre el número de buques y el alto número de organismos regionales con bases de datos no armonizadas que dificultan la agregación de los datos.

Resultados preliminares revelan que criterios como el estudio de la pesca en alta mar u otras Zonas Económicas Exclusivas (ZEEs), tipo de barcos e informes históricos de actividades de pesca INDNR permiten definir una eslora mínima de referencia. No obstante, con objeto de determinar cuál es la capacidad de asignación de números IMO a buques pesqueros existentes por parte de la compañía privada que gestiona el esquema de numeración de la OMI, es necesaria la realización de un estudio complementario.

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LIST OF ACRONYMS

AIS	Automatic Information System
CCAMLR	Commission for the Conservation of Antarctic Marine Living Resources
CCSBT	Commission for the Conservation of Southern Bluefin Tuna
CFR	The unique vessel identifier used in the EU Fleet Register
CLAV	Consolidated List of Authorized Vessels
COFI	FAO Committee on Fisheries
DG MARE	Directorate-General of the European Commission for Maritime Affairs and Fisheries
EC	European Commission
EU	European Union
EU FR	Community Fleet Register
FAO	Food and Agriculture Organization of the United Nations
FFA	Pacific Islands Forum Fisheries Agency
FIPS	Statistics and Information Branch (FAO, Fisheries and Aquaculture Department)
FIGIS	Fisheries Global Information System
FIRO	Fishing Operations and Technology Branch (FAO, Fisheries and Aquaculture Department)
FLUX	Fisheries Language for Universal eXchange
FVF	Fishing Vessel Finder
GFCM	General Fisheries Commission for the Mediterranean
GFW	Global Fishing Watch
GISIS	Global Integrated Shipping Information System
GRT	Gross Registered Tonnage
GRWG	Global Record Working Group
GT	Gross Tonnage
HSVAR	High Seas Vessel Authorization Record
IATTC	Inter-American Tropical Tuna Commission
ICCAT	International Commission for the Conservation of Atlantic Tunas
IHSM	IHS Maritime
IMCS network	International Monitoring, Control and Surveillance Network
IMO	International Maritime Organization of the United Nations
IOTC	Indian Ocean Tuna Commission
IPOA-IUU	International Plan of Action to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing
ITF	International Transport Workers' Federation
IUU Fishing	Illegal, Unreported and Unregulated fishing
LOA	Length Overall
MCS	Monitoring, Control and Surveillance
NEAFC	North East Atlantic Fisheries Commission
PSMA	Port State Measures Agreement
RFMO	Regional Fisheries Management Organization
RFVR	Regional Fishing Vessel Register
SEAFO	South East Atlantic Fisheries Organization
SIOFA	South Indian Ocean Fisheries Agreement
SOFIA	State of World Fisheries and Aquaculture (FAO Fisheries Department Flagship publication)
SOLAS	International Convention for the Safety of Life At Sea
SPRFMO	South Pacific Regional Fisheries Management Organization

TC	Technical Consultation
T-RFMOs	Joint Tuna Regional Fisheries Management Organizations
UN/CEFACT	United Nations Centre for Trade Facilitation and Electronic Business
UNODC	United Nations Office on Drugs and Crime
UVI	Unique Vessel Identifier
VG-FSP	Voluntary Guidelines for Flag State Performance
WCPFC	Western and Central Pacific Fisheries Commission

I. INTRODUCTION

The thesis here presented, called *Feasibility Study on the expansion to phases 2 and 3 for The Global Record for fishing vessels, refrigerated transport vessels and supply vessels (Global Record)*, is carried out under the framework of the final project foreseen for the Sustainable Fisheries Management Master studies held by the University of Alicante starting on 2013. This study, then represents the thesis of the Master and takes place in the course of an international consultancy contract with the Food and Agriculture Organization of the United Nations (FAO) as part of one of the functions and terms described for the recruitment.

The Global Record could be briefly defined as an essential tool conceived to combat illegal, unreported and unregulated (IUU) fishing by enhancing transparency and traceability on fishing activities. To achieve this, the Global Record gathers and disseminates certified, unequivocal information about vessels and vessel-related activities provided by the official State authorities responsible for it. One of the major characteristics and particularities of the Global Record program, is its current status of development and implementation throughout the period of development of the thesis. Hence, in order to understand the whole context in which this study was produced, it has to be understood that the program entailed the accomplishments of the deadlines and commitments agreed. Extra time had to be allocated to the feasibility study and great coordination was needed to move both fronts forward. As example, great efforts were made by the incumbent for the preparation of the first working version of the Global Record information system, that was released by the end of April 2017 and is accessible only for the FAO Members to fill the system with fleet data before going into a public launch. Furthermore, at the end of June, the third meeting of the Informal Open-ended Working Group of the Global Record was organized. In this meeting crucial issues were discussed by experts representing Technical and Advisory FAO Member States and observers.

Amid all this background work, aiming to advance further and consider the implementation of the Global Record to smaller vessels than 24 meters, this feasibility study was demanded. The angle envisions for the development of it and the intention pursued was to deduct what shall be the adequate criteria and minimal requirements that fishing vessels (refrigerated transport and supply vessels are excluded) should fulfil in order to define a minimum boundary, outside which, fishing vessels will not need to be included into the Global Record information system. It was then studied, under which criteria could be minimize the number of fishing vessels needed for optimizing the usability of the system without undermining its objective of deterring, preventing and eliminating illegal, unreported and unregulated (IUU) fishing by the enhancement of transparency and traceability. It is also necessary to point out that lower numbers of fishing vessels contribute to allow a more reliable identification procedure by the company in charge of issuing IMO number, IHSMarkit.

1. An insight to the FAO

The Food and Agriculture Organization of the United Nations, was born as a specialized United Nations agency in its first session Conference attended by 42 countries and held on 16th October 1945, in Quebec, Canada. Their initial goal was to free humanity from hunger and malnutrition, and to effectively manage the global food system. Nowadays, with its headquarters settled in Rome and 194 country members (plus one Member Organization, the European Union and two Associate Members, The Faroe Islands and Tokelau) and seven decades later, its goals, had evolved into five major strategic objectives:

- Help eliminate hunger, food insecurity and malnutrition
- Make agriculture, forestry and fisheries more productive and sustainable
- Reduce rural poverty
- Enable inclusive and efficient agricultural and food systems
- Increase the resilience of livelihoods to threats and crises

These strategic objectives represent the final goals sought by all the projects conducted and implemented in the FAO, with complex targets that must be addressed from a wide range of different expertise. Therefore, to accomplish these tasks entailing the utmost responsibilities, the FAO is organized into seven departments specialized in the following different areas:

- Agriculture and Consumer Protection
- Climate, Biodiversity, Land and Water Department
- Corporate Services
- Economic and Social Development
- Fisheries and Aquaculture
- Forestry
- Technical Cooperation and Programme Management

The Fisheries and Aquaculture Department [1], once composed by two divisions, is currently comprised just in one, the Fisheries and Aquaculture Policy and Resources Division gathering six different branches. Amongst those six, the Fisheries Operations and Technology Branch, is the one hosting the Global Record project here studied.

Regarding the Organization's governance, it was defined at its founding conference of Quebec through its Constitution. Derived from its mandate, the Conference was established as the sovereign Governing Body of the Organization, entrusted primarily to determine the policy and approve the budget of the Organization. In a second stage and acting as the Conference's executive organ between their sessions, is the FAO Council, second major decisive body under which, other bodies as the Committees are created, to assist the Council, by organizing the work of the different areas of activity. In the case

[1] FAO website: http://www.fao.org/fishery/en

of the Fisheries and Aquaculture Department, the Committee on Fisheries (COFI) established in 1965 under the Council, was empowered to lead the work of the Department.

2. Basic Concepts

2.1. Registration

The term registration refers to the entering of a matter into formal public records. Every flag State[2] has the duty to fix the conditions at their discretion for it. Registration entails the subjection of the vessel to the State's jurisdiction and hence, the access to different rights as flying the national flag, diplomatic and naval protection, the right to fish on jurisdictional waters and other rights resulting from the Private Law as the protection of the title of the registered owner.

The registration of a vessel by a State, bounds the ship to the law of its flag State and impose the assumption by the State of national and international responsibilities concerning the vessel.

2.2. Vessel Records

The record of a vessel in contrast, does not imply a register of ownership or nationality. It does not have a legal effect or link. Vessels may enter records of countries or Regional Fisheries Management Organizations (RFMOs) specifying ownership details with no legal consideration.

The Global Record of Fishing Vessels, Refrigerated Transport Vessels and Supply Vessels then, compiles and disseminate vessel data from their flag States or relevant authorities without establishing any legal link resulting from the submission of the vessel into the information system. Nevertheless, vessels uploaded into the Global Record have been registered in their respective flag States previously, and therefore, their flag States assume responsibility from their actions.

2.3. Ilegal, Unreported and Unregulated (IUU) fishing

The IUU fishing terminology has its origins in the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR), where it first appeared as an item of the agenda of CCAMLR's Session of 1997 on Observation and Inspection. Since then, it has been subsequently diffused widely in the international community, including FAO. Becoming essential to understand the importance and need of the Global Record Project, to comprehend the concept of illegal, unreported and unregulated (IUU) fishing and its deep impact on sustainability, employment, economy and food safety particularly for coastal regions.

[2] As elaborated in the 1982 United Nations Convention on the Law of the Sea (UNCLOS)

Defined succinctly[3] as the activities conducted by any vessel in international or national waters in contravention with the laws and regulations adopted by the coastal States, regional fisheries management organizations or the international law establishing State responsibilities for the conservation of living marine resources. The illegal unreported and unregulated fishing according with some estimations, may account for up to 26 million tons of fish a year, 15% of the world's total annual capture fisheries output (SOFIA report 2016). Very significant figures that involve in most of the cases the use of industrial and non-responsible practices, carried out without the regard of sustainability of fisheries and biodiversity, undermining management efforts that might lead to stock depletion or hinder stocks from recovering.

Moreover, IUU fishing practices threaten food security for coastal communities, mostly belonging to developing countries, with no control capacity or under political instability periods, vulnerable and strongly dependent on their resources. Other aspects of IUU fishing may involve the engagement in a range of other illegal activities including: corruption; money laundering; slave labor; and document, tax and customs fraud, among others, calling for international action against IUU fishing (UNODC, Transnational Organized Crime in the Fishing Industry, 2011).

2.4. Phases of the Global Record

Given the high number of existing fishing vessels, the Global Record was conceived as a phased tool, yet in his prior feasibility study on 2006. This preliminary distribution later discussed and supported by COFI aimed to shorten the large number of existing fishing vessels, as well as to prioritize firstly, the inclusion of the largest ones due their bigger engagement on international fishing activities and fishing impact. The phases resulted, that will be under discussion along the study refer to the following Length Overall (LOA) and tonnage (in GT or GRT) ranges:

Table 1: phases of the Global Record

PHASES	LOA	GT or GRT
Phase 1	≥ 24m	≥ 100
Phase 2	≥ 18m but < 24m	≥ 50, but < 100
Phase 3	≥ 12m but < 18m	≥10, but < 50

The criteria used for establishing whether a vessel belong or not to an specific phase in the cases where the length and the tonnage correspond to different phase ranges, was to

[3] As per International Plan of Action to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing (IPOA-IUU)

incorporate the vessel on the upper phase in order to be more inclusive.

2.5. The Global Record and the Unique Vessel Identifier (UVI)

The Unique Vessel Identifier (UVI) is a global unique number that is assigned to a vessel to ensure traceability through reliable, verified and permanent identification of the vessel. Once allocated, the UVI is with the vessel for its entire life, regardless of changes in its flag, ownership, name or other[4]. It is the key component of the Global Record and one of the five minimum essential fields required for submitting a vessel record into the Global Record information system. Despite its relevance, currently the use of the UVI number is still not widely spread in the fishing world. Although some FAO members as the European Union have changed their legislation in order to incorporate it to their fleet and there have been initiatives driven by some regional fisheries management organizations (RFMOs) for implementing UVI numbers on their areas of regulations.

At its origin, the use of an UVI was firstly recommended to member States and RFMOs in 2003, by the FAO's Coordinating Working Party on Fishery Statistics, which recognized that a unique vessel identifier field should be added to each vessel record to facilitate interagency data exchange and traceability (CWPFS 2003). The Unique Vessel Identifier (UVI), was later supported by the feasibility study for the Global Record of November 2006 and the following year on the 27th Session of the Committee on Fisheries (COFI). Nevertheless, as these actions are very recent, in order to analyze current existing numbering schemes and possibilities for the determination of the best suitable solution, a study commissioned by FAO was undertaken on 2010 (MRAG Asia Pacific Pty Ltd, 2010). The conclusions positioned the IMO Number as the best solution, on the basis that "it represents the highest system integrity, the minimum amount of duplication, the maximum amount of compatibility with existing maritime vessel systems, the most rapid start-up and probably the lowest cost".

2.6. The International Maritime Organization (IMO) Ship Identification Number Scheme

The International Maritime Organization (IMO) Ship Identification Number Scheme is currently the most comprehensive global identification scheme and is managed by IHSM&T, on behalf of the IMO. The IMO number consist on a seven digit number following the letters IMO, with the seventh digit being a digit of control that is assigned to a vessel since its construction in the shipyard to its scrap, with no possibility of reusing the same number for another different vessel as established on the IMO Numbering Scheme.

This numbering scheme was originally initiated with the IMO Resolution A.600 (15) in 1987 that adopted the Lloyd's Register-Fairplay's numbering scheme in use since 1969, with the objective to fight ship fraud, prevent pollution and enhancing maritime security and safety. It was firstly created as a voluntary scheme. However, in 1994 the adoption of the amendment to the International Convention for the Safety of Life At Sea of 1974

[4] Global Record website: http://www.fao.org/global-record/background/unique-vessel-identifier/en/

(SOLAS XI-1/3) made it binding for passenger ships of 100GT and above, and for all cargo vessel ships of 300 GT and above. In 1996, this was extended to all ships subject to SOLAS.

For fishing vessels, it was not until December 2013 when finally, Resolution A.600 (15) was revoked by Resolution A.1078 (28) on IMO Ship Identification Number Scheme, to include the voluntary application to fishing vessels of 100 GT and above. In 2014 COFI 31[5] agreed to the use of the IMO number as the UVI for Global Record's phase 1. Regarding vessels below 100 GT, the need to carry out a feasibility study was suggested at COFI 31 and later recognized by the Global Record Working Groups.

Currently, by 24th June 2017, in the live fleet with IMO numbers there are 23,564 fishing vessels of 100 GT and above and 502 fishing vessels of 100 GT and below. The majority correspond to phase 1, and they represent a third of the estimated fleet (64,000 vessels). With regards to the other two phases, in a huge leap forward, in order to facilitate the numbering scheme in support of the Global Record, a circular was approved by the IMO on October 2016. This circular aimed to amend the Resolution A.1078(28) and therefore to extend the numbering scheme to fishing vessels of non-steel hull construction of 100 GT and above, as well as to fishing vessels of less than 100 GT down to a size limit of 12 meters in length overall (LOA), that are authorized to operate outside waters under national jurisdiction (IMO, 2016). The approval of this amendment is expected by the end of the year 2017.

The Strategy Document recommended the use of IMO Number as the UVI, and suggested that expansion to Phases 2 and 3 will need careful consideration due to the numbers of vessels involved (above 350,000) and the possibilities of expansion of the UVI to these size categories. The way forward will have to be considered through a targeted feasibility study (the present study) and dedicated expert meetings whilst taking into account the experience gained during Phase 1.

2.7. IHS Maritime and Trade (IHSM&T), former Lloyd's Register

As a brief introduction, IHS, since its beginnings on the 1800's as an insurance company has been providing numbers to vessels all over the world with the objective of reducing fraud and enhancing legal security through the uniqueness and permanency of their numbers.

Its early activity and longstanding experience helped them to build the most complete vessel's database and to create the expertise and manpower required consolidating the company internationally. It is claimed to be the only organization able to provide comprehensive details of the world merchant fleet of 100 GT and above (over 91,000 ships) and the largest database of maritime companies (a total of over 154,000). Their worldwide network of agents, shipyards and correspondents providing data access and verification combine with their vast database for further validation, raised them as perfect candidates for the numbering scheme intended later by the IMO on their Resolution

[5] Report of the Thirty-first Session of the Committee on Fisheries: http://www.fao.org/3/a-i4634e/index.html

A.600 (15) in 1987. Nowadays, IHSM&T is therefore the manager of the IMO identification numbering scheme on behalf of the IMO.

With regards to fishing vessels, although not yet included in the Resolution A.600(15), and in some cases by recommendation of some RFMOs, IHSM&T started informally assigning IMO numbers to those vessels that applied for it, even prior to Resolution A1078(28). However, referring fishing vessels, there were some inconvenient related. The high number of vessels involved meant a huge validation, updating and verification effort by the private company. The lack of capacity, economical interest on the fishing fleet and little expertise of IHSM&T in this fleet, compromising the reliability of the UVI, posed some uncertainties on the solution of adopting the IMO Number as the UVI.

3. Background

3.1. Developments with regards to Vessel Records

The legal framework in which the Global Record is set currently comes from the old conception and one of the fundamental principles of international law, known as the **Freedom of the Seas**. It established the high seas are free to all and incapable of acquisition by occupation. Even unwritten, in an attempt of avoiding abuse and impunity it was already assumed by the customary law the recognition that vessels on the high seas are under the exclusive authority of the State whose flag they fly[6]. This jurisdictional bound would then be strengthen by the convention and treaty law to force compliance with those agreements adopted by the States, taking as point of depart the **1958 Convention on the High Seas of the United Nations Conference on the Law of the Sea (UNCLOS)**, held at Geneva in 1958, art.5:

1. *"Each State shall fix the conditions for the grant of its nationality to ships, for the registration of ships in its territory, and for the right to fly its flag. Ships have the nationality of the State whose flag they are entitled to fly. There must exist a genuine link between the State and the ship; in particular, the State must effectively exercise its jurisdiction and control in administrative, technical and social matters over ships flying its flag.*

2. *Each State shall issue to ships to which it has granted the right to fly its flag documents to that effect."*

Thus, in the 1958 Convention, for the first time in history States were committed to apply conditions for vessels to register on their territories and to fly their flag, with the provision of maintaining a genuine link with those vessels.

Lately, in the third United Nations Conference on the Law of the Sea (UNCLOS III), the international community reinforced this initial arguments adopting the text known as the **1982 United Nations Law of the Sea Convention**. In this text, on its PART VII about the High Seas' general provisions, duties for the flag States concerning the need

[6] Lotus Case. Judgement available online at:
http://www.worldcourts.com/pcij/eng/decisions/1927.09.07_lotus/

of national registries were introduced:

"(a) maintain a register of ships containing the names and particulars of ships flying its flag, except those which are excluded from generally accepted international regulations on account of their small size; and

(b) assume jurisdiction under its internal law over each ship flying its flag and its master, officers and crew in respect of administrative, technical and social matters concerning the ship."

Hence, since the 1982 Convention, the law of the sea established that flag States shall create and maintain a register of ships flying its flag with the only exception of those vessels that by means of their length are considered very small and not accountable to register. Either because in many parts of the world they are still handmade or very numerous, requiring a major effort for countries' administrations. Moreover, the responsibility upon those vessels under their flag is strengthened and extended to all crew members, nevertheless they are not meant to cooperate exchanging other information than catch and fishing effort statistics for scientific purposes.

Subsequently, in an attempt of addressing non-responsible fishing practices in international waters by enhancing transparency, the countries formulated the Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessel on the High Seas (hereafter referred to as the 1993 Compliance Agreement). The 1993 Compliance Agreement originally intended as a mechanism to prevent re-flagging of fishing vessels for the purposes of avoiding international conservation and management measures, was designed to reinforce flag State responsibility for fishing activities and to provide for data exchange regarding high seas fishing operations. Although this agreement did not enter into force until April 2003, it advanced matters of great importance and relevance to the Global Record.

The 1993 Compliance Agreement established the duty for the Parties to maintain a national register of vessels authorized to operate in the High Seas as well as to cooperate between them and what is more, to provide to the FAO information related with the vessels domestically registered under Article IV of the Agreement. This mandatory and discretionary data gathered and compiled by FAO, served to create the High Seas Fishing Vessel Authorization Record (HSVAR), an initial concept close to the Global Record that will be discuss in depth on a subsequent chapter.

In the meanwhile, international events leading to the depletion and collapse of historical stocks as the Canadian cod that ended on serious diplomatic incidents, pushed forward to incorporate new international measures aiming to reinforce international regional bodies. These likely lead to the adoption of the **Agreement for the Implementation of the Provision of the United Nations Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks 1995** (hereafter the UN Fish Stocks Agreement). This Agreement aimed to enhance cooperation between countries operating on the High Seas and coastal States for the effective conservation and sustainable management of straddling fish stocks and highly migratory species and to strengthen regional or subregional fisheries management organizations or arrangements.

Related to fleet records, the UN Fish Stocks Agreement not only reminded of the necessity of establishing a national record of fishing vessels authorized to fish on the high seas, but also the provision of sharing this record with other interested States. This issue is developed extensively on its Annex I, that establishes with regards to vessel data, the minimum data fields needed for standardizing fleet composition. Regarding data exchange at the global level FAO is entrusted with the task of collecting and disseminating the data, which could be done through a Global Record.

Later, in the context of the Code of Conduct for Responsible Fisheries and its overall objective of pursuing sustainable fisheries, the issue of illegal, unreported and regulated (IUU) fishing in world fisheries became of serious concern. Information indicating increase in IUU fishing, including the use of "flags of convenience" claimed for action. As low political will for ratifying and implementing existing instruments addressing IUU fishing was the norm, in order to draw attention to the problem, a targeted International Plan of Action was developed under the framework of the Code of Conduct. The FAO International Plan of Action to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing (hereafter IPOA-IUU), is thus a voluntary instrument adopted in 2001, that defined in detail for the first time IUU fishing, here expressed briefly, as the activities conducted by any vessel in international or national waters in contravention with the laws and regulations adopted by the coastal States, RFMOs or the international law and establishes State responsibilities for the conservation of living marine resources. Regarding vessel records, based on the provisions established on that matter in the 1993 Compliance Agreement, the IPOA-IUU extended the data required to historical names, ownership history and beneficial ownership data, as well as more dimensional characteristics. Since the IPOA-IUU is an instrument of soft-law, the international community intended also to encourage countries to ratify the relevant international instruments aforementioned, or at least to not act in a manner inconsistent with these instruments.

3.2. Global Record History

In a moment in which the IUU fishing started to raise concerns in the international community at first reluctant to ratify and implement the legal instruments aforementioned, the Global Record is proposed initially in the **2005 Rome Declaration on IUU Fishing**[1] (Ministerial Meeting on Fisheries; Rome, 12 March 2005). The growing international demand for a comprehensive worldwide fishing vessel and fishing-related vessels record that complies with the maximum integrity standards prevails since last decade. The justification is the need to shed some light on fishing activities and also reliably identify the vessels engaged in IUU fishing in order to be able to take further actions by means of the regulations in force. This basic need that positioned the Global Record as a fundamental and powerful tool, that could play a crucial role in ensuring the effectiveness of binding and non-binding instruments designed to deter, prevent and eliminate IUU fishing and related activities.

One of the key and new aspects of the 2005 Rome Declaration was the recommendation to "develop a comprehensive global record of fishing vessels within FAO, including refrigerated transport vessels and supply vessels, that incorporates available information on beneficial ownership, subject to confidentiality requirements in accordance with

national law". It recognized the significant role that refrigerated transport vessels and supply vessels play in facilitating IUU fishing, as well as the value of the beneficial ownership data for tracking the source of these practices.

In response to the Ministerial Meeting in Rome, March 2005, an assessment study on the feasibility and viability of FAO undertaking the creation and maintenance of a global record of fishing vessels, support vessels and the beneficial ownerships was performed. The study concluded that, it was feasible but on a step by step basis, considering the need to introduce a unique vessel identifier that would allow to track vessels over time even if they changed name, ownership or flag.

During the Twenty-seventh Session of the Committee on Fisheries (COFI), held in Rome (March 2007) the convening of an Expert Consultation[7] to provide guidance regarding the future development of a comprehensive Global Record was approved, to identify appropriate next steps, including how technical development should progress. This Expert Consultation was called to clarify the scopes, studied legal aspects, other existing vessel records, sources of data and the related implications of the 2009 Port State Measures Agreement to prevent, deter and eliminate illegal, unreported and unregulated (IUU) fishing (hereinafter PSMA)[8]. The report also included some recommendations also on the requirement of a unique vessel and company identifier, amongst others.

As a result, in the Twenty-Eigth Session of COFI held in Rome (March 2009)[9], many members supported the development of a Global Record, stressing the importance of cost-effectiveness and highlighting existing systems and information technology (IT) platforms undertaken by some RFMOs in developing their own vessel records and establishing their own identifiers. In welcoming the creation of the Global Record, FAO Members also supported a future program of work, which should include the needs of developing countries, designing and implementing a pilot project and preparing a comprehensive technical report which led to a Technical Consultation on the Global Record in November 2010. The aim of this Technical Consultation (TC) was to identify a structure and a strategy for the development and implementation of the Global Record. The strategy agreed was a phased and flexible approach based on the provision of UVI numbers from a certain length that included all types of vessels, except recreational of 10GT, 10GRT or 12m and above, within marine and inland waters. The responsibility of the flag State on their vessels was also highlighted. Regarding the implementation, it was recommended to be a voluntary initiative.

The recommendations produced by the Technical Consultation were discussed at the Twenty-Ninth Session of COFI (2011)[10], where Members reiterated their support for the Global Record project, as a useful tool to combat IUU fishing. In this session, the Committee recognized that the Global Record should be developed as a voluntary

[7] The report of the Twenty-eigth Session of the Committee on Fisheries is available at: ftp://ftp.fao.org/docrep/fao/010/i0149e/i0149e00.pdf

[8] The 2009 Agreement on Port State Measures to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing, is available at the website: http://www.fao.org/3/a-i5469t.pdf

[9] Report of the Expert Consultation on the Development of a Comprehensive Global Record of Fishing Vessels available at: ftp://ftp.fao.org/docrep/fao/012/i1017e/i1017e00.pdf

[10] The report of the Twenty-ninth Session of the Committee on Fisheries is available at: http://www.fao.org/docrep/014/i2281e/i2281e00.pdf

initiative under FAO´s supervision, through a phased approach to implementation and in a cost-effective manner to take advantage of existing systems and information technology (IT) platforms.

A year later, the Thirtieth Session of COFI (2012)[11] reiterated its support to the Global Record project, recognizing as its key component the need of a global unique vessel identifier (UVI). The Committee suggested as a first step the UVI to be applied to vessels above 100 GRT. In order to create synergies, the Committee noted the necessity to avoid duplication with other initiatives and to coordinate also with RFMOs´ existing vessel records to keep it cost-effective. The Committee also appreciated FAO´s work to assist developing States to strengthen their national or regional vessel registries.

All previous issues where addressed on the Thirty-First Session of COFI (2014)[12], where the Committee reiterated its support and commended FAO´s work for the Strategy Document (FAO, 2014) presented on the Global Record´s way forward and for the demonstration of the prototype system. This prototype used standardized vessel related characteristics and for the first time the IMO number for fishing vessels as unique identifier. The Committee appreciated the collaboration with IMO for extending the UVI number that started to be in use by RFMOs. It agreed that the States are responsible for the data and its provision and appreciated FAO´s assistance to developing States. In order to find a long-term financing solution and to clarify outstanding issues, some of the members recognized the need for an advisory committee, that under the Secretariat proposal became the Global Record Informal Open-Ended Technical and Advisory Working Group (GRWG).

Since then till the next COFI[13], two meetings of the GRWG took place on February 2015 and March 2016. Those meetings, helped build the framework in which a publicly-available operational pilot system is being developed. In the GRWG the Member States and Observers provided guidance on the structure of the Global Record by deciding to expand it with the incorporation of new information modules as vessel´s authorizations, compliance and historical data, as well as agreeing on the inclusion of specific data fields, the importance of data quality and cross-checking of information, transmission mechanisms that could facilitate the data submission also for developing Members; and the establishment of core specialized working groups to deal with very technical matters, amongst others. Within the core specialized working groups the data requirements were finally defined and completed, the involvement of third party data was addressed and the data exchange mechanisms specified.

All this was agreed before the major international event of the year, the entering into force of the first binding Agreement specifically targeting to prevent, deter and eliminate IUU fishing, on 5 June 2016. The Port State Measures Agreement (PSMA) has been ratified to date by 57 countries and the European Union[14], which signed as a

[11] The report of the Thirtieth Session of the Committee on Fisheries is available at: http://www.fao.org/3/a-i3105e.pdf
[12] The report of the Thirty-first Session of the Committee on Fisheries is available at: http://www.fao.org/3/a-i4634e/index.html
[13] The report of the Thirty-second Session of the Committee on Fisheries is available at: http://www.fao.org/3/a-i6882e.pdf
[14] Status of the PSMA, available at the website: http://www.fao.org/fileadmin/user_upload/legal/docs/037s-e.pdf

single party. This agreement aims to fight IUU fishing through the adoption and implementation of effective port State measures that apply to foreign vessels when seeking entry to their port or while they are in port. Moreover, in its article 15 paragraph 2, indicates that:

"To the extent possible and with due regard to appropriate confidentiality requirements, Parties should cooperate to establish and information-sharing mechanism, preferably coordinated by FAO, in conjunction with other relevant multilateral and intergovernmental initiatives, and to facilitate the exchange of information with existing databases relevant to this Agreement."

Which in the absence of another mechanism, opens the possibility for the Global Record of becoming an useful information system in support of the agreement.

During the Thirty-Second Session Committee on Fisheries (COFI) meeting in Rome, July 2016, the Committee again reiterated its support for the Global Record recognizing in this sense that it could play an important role in combatting IUU fishing and in supporting other related international instruments. Including the recently adopted binding Agreement on Port State Measures. With the pilot project ongoing and the Informal Open-Ended Technical and Advisory Working Group and the core specialized working groups running, the Committee commended the progress made and urged broader participation by Members to ensure its success.

On December 2016, the pilot version with 11 pilot members for testing the information system before is final release was announced. The pilot members involved in an attempt of engaging geographical representativeness were: Colombia, Comoros, Ghana, Iceland, Indonesia, Mauritius, Mozambique, Philippines, Seychelles, Spain and Uruguay. This served to refine the information system for its recent release on April 2017, where the first working version of the Global Record was launched only for FAO Member States who, in the coming months, will be compiling and inserting data prior to its public launch.

3.3. Current situation of the Global Record

Currently, after convening the third meeting of the Global Record Informal Open-Ended Technical and Advisory Working Group during June (26-28) in FAO headquarters, the Global Record information system needs to be populated with data by the FAO Members. In order for the tool to be useful prior to its public release, a critical mass on number of fishing vessels should be included. Ideally the target could be set on at least half of the phase 1 total number of fishing vessels with IMO numbers (around 10.000 fishing vessels) preferably from a variety of FAO Member States. To this end, the reiterated support by the members of the Committee of Fisheries (COFI) urging for a broad participation has to turn into concrete action.

In a moment in which the international commitment against IUU fishing took a step forward developing other complementary key instruments, as the recently ratified Port States Measures Agreement and the Voluntary Guidelines for Catch Documentation Schemes, the Global Record appears as a basic and essential tool forging particularly

effective synergies with all of them. Nevertheless, its final success will rely on this international commitment and willingness for enhancing transparency and to prevent, deter and eliminate IUU fishing practices.

4. Justification

Already in the prior feasibility study undertaken by 2006, the question on whether or not including all fishing vessels or to establish a practical lower limit was raised. At that moment, three different options were already suggested:

- all fishing vessels operating in marine waters, or
- marine waters but limited to powered decked vessels, or
- decked powered vessels in marine waters, but setting a lower tonnage or length limit.

Given that the Law of the Sea, as aforementioned, considered an exception on account of their small size to the requirement for flag States to maintain a register of ships, the feasibility study of the 2006 recommended to set the lower limit on decked powered vessels of 10 GT and above. Proposing a phased approach for the development of the Global Record, starting with vessels above 100GT, followed by vessels between 50GT and less than 100GT, and at last by vessels from 10GT to less than 50GT. All of them with a UVI number assigned as an essential requisite.

Since then, the need for the Global Record and the use of UVI numbers as a key aspect was reiterated in the following COFI meetings. Nevertheless, the formula was still to discover. Some studies as the Investigation of Unique Vessel Identifier (UVI) and Phasing Options on 2010, attempted to shed some light on the feasibility of assigning IMO numbers to all phases, examining different options.

However, prior to the IMO circular letter the willingness of IHS private company for extending the IMO number and the derived costs of dealing with the incorporation of more than 400.000 units, presented a great challenge.

Since then, on July 2014, COFI 31 endorsed the use of the IMO number as the Global Record's unique vessel identifier for Phase 1, whilst expansion to Phases 2 and 3 was considered to be addressed through a targeted feasibility study according to the Strategy Document presented to COFI 31 and based on the experience based through the implementation of Phase 1. This study was subsequently requested by the consecutive meetings of the Global Record Working Group.

5. Objectives

Given the difficulties experienced by some developing States and the operability of an information system with almost half a million vessel records, it is necessary to examine the need or usefulness of including all fishing vessels in the three phases into the Global Record information system. Consequently, the main objective of this thesis, is to draw

valuable conclusions about optimal criteria that should be consider to limit the number of fishing vessels that should be uploaded in the Global Record information system in relation with the length and tonnage distribution considered. The criteria chosen must not compromise either its effective implementation or fighting capacity against IUU fishing by means of increase of transparency. Once selected the criteria, based in the different phases of the Global Record, to determine the feasibility of expanding the coverage of the Global Record, the resulting number of fishing vessels would be discussed.

The feasibility of the expansion of the IMO number to vessels above 10GT or 12m is not addressed under this Study, as this would form part of a parallel study carried out by the private company IHS M&T, responsible of issuing the IMO numbers on behalf of IMO.

As consideration, for the purpose of this study, only fishing vessels were considered for analysis. Information relative to activities of refrigerated transport vessels and supply vessels is scarced at present. However, identification information and other characteristics are available in other sources of information relative to the maritime sector such as GISIS, EQUASIS and IHSM Seaweb.

Moreover, other ancillary objectives were:

I. The quality of the outcomes of this study relies on the accuracy and availability of global fleet data. Nowadays, there is a great gap on data availability, reliability and accuracy for the global fleet. This continues to be an issue for the FAO. Hence, as ancillary objective, this study by means of incorporating new sources of data as AIS and questionnaires, seeks to contribute to shed some light on global figures.

II. In the implementation stage the Global Record program foresees the need of Capacity Development activities for broadening participation and supporting developing countries on achieving the minimum standards needed for engaging and becoming active users. Therefore, a secondary objective of the present feasibility study would be to guide the implementation phase.

III. Finally, if the conclusions are solid enough and objectives are achieved, a possible feasibility study undertaken by IHS Fairplay, would have another source of cross-checked and referenced information to support their conclusions.

II. MATERIAL

6. Data sources consulted

The feasibility study of the Global Record is grounded on many different sources of information, including FAO databases and public and private Information Systems some renowned by their reliability and accuracy. The main effort was focused on obtaining all the data through a unique official source of fleet data information, that refers to the flag States. Nevertheless other sources, presumably applying high procedural standards were taken into consideration for crosscheck and analysis. In addition, in order to complete gaps of information and reduce uncertainty, a survey was conducted with FAO Members allowing also to dig deeply into the matter. All the sources taken into consideration in this study are below presented:

6.1. FAO sources

Fisheries and Aquaculture Statistics and Information Branch (FIAS - FAO)

- Description

The Statistics and Information Branch (FIAS)[15] belongs to the Fisheries and Aquaculture Policy and Resources Division (FIAX) of the Fisheries and Aquaculture Department of the Food and Agriculture Organization of the United Nations (FAO). In the attempt of assessing all the world´s fleet number and capacity, FIAS, is responsible for the collection, compilation, validation, analysis and dissemination of reliable up-to-date fisheries statistics. For this, FIAS every year enquiries Member countries about their fleet´s characteristics by means of two statistical questionnaires (FISHSTAT FF) named FF1 and FF2. FAO relevant fleet assessment reports included SOFIA (FAO, 2016) and The FAO Yearbook[16] are based on these questionnaires.

This data source constitutes a unique and important statistical collection on theglobal fleet starting approximately from the year 1950. Since 1996, several changes were implemented in the FISHSTAT FF inquiry: only fishing vessels were considered excluding non-fishing support vessels (such as fish carriers, motherships, research vessels, etc.) from the inquiry and distribution by length classes gained importance.

- Characteristics

[15] Further information available at: http://www.fao.org/fishery/about/organigram/en#Org-OrgStruct.8
[16] The FAO Yearbook. Fishery and Aquaculture Statistic of 2014, is available at: http://www.fao.org/3/a-i5716t.pdf

Form FF1 is used for the collection of data on “decked vessels”, whereas for FF2 is intended for “undecked vessels”. The data fields requested included the following technical characteristics of countries´ fleets:

Table 2:Data fields of FAO's statistical forms FF1 and FF2

FFI (for decked vessels)	FF2 (for undecked vessels)
• Length Overall (LOA) • Gross Tonnage (GT) • Power • Type of vessel	• Length Overall (LOA) • Powered / Not Powered • Type of vessel

Where possible, other pertinent information available on the countries statistics is also required, such as the average age of the fleet, or other readily available information.

Form FF1 collects mainly numbers and capacity data for broad groups of fishing vessels types. Form FF2 instead made the most important distinction between “powered” and “not-powered” crafts. In both enquiries the LOA is defined as the main characteristic of measurement in international data collection.

Due to these forms FF1 and FF2 do not distinguish between continental, aquaculture or marine fishing vessels, data from inland countries were not considered and further adjustments in fleet numbers were performed with the assistance of the enquiries conducted. In those cases where inland countries possess Open Registries that host marine fishing vessels (e.g. Bolivia), statistical fishing vessel information was considered.

Data collected from FIAS goes till 2014 as the most recent year. Those countries with incomplete historical series of fleet data submission for 2014, were completed considering the last year reported back till 2008 maximum, assuming no vessel variation since the last figures submitted. Not assigning any fleet number to those States would derive on a greater error. In cases in which, reported figures by the countries weren´t reliable, FAO estimations (“F”), were considered for this study.

To sum up, before moving on, the database compiled by FIAS as aforementioned is unique and the most comprehensive one of the global fleet that exists. Therefore, its extensive nature and years of development, attest there is no better background source of information ready to use today. Acknowledging it, FIAS database was used and refined by means of other sources that will be later explained, to produce the most accurate and approximate estimations on global fleet data for the three phases established for the Global Record. The main weakness is that no further detail data is available on those fleets.

Fishing Vessel Finder

(20 data fields)

- Description

The Fishing Vessels Finder (FVF) is a public online tool developed by FAO with the objective of disseminating from a single unique information system, data on individual fishing vessels (including supporting vessels, carriers, fishery research vessels and inspection boats). The data displayed is compiled from online public available sources covering national, multi-national, regional and international organizations, being its more representative sources the European Union, Transport Canada website of the Government of Canada (TCGC) and Alaska Department of Fish and Game, apart from some tuna Regional Fisheries Management Organizations. In order to reduce duplicities for vessels recorded on different organizations and registries, the Fishing Vessel Finder runs matching algorithms based on relevant vessel's identification data and characteristics. Once a duplicate is identified by the software, all the entries for each vessel are grouped and displayed on the individual vessel search result, letting it up to the user to judge the most appropriate vessel record.

Due to the fact that the databases used as sources do not follow same classification standards, FVF have developed a code-mapping capabilities, to allow standardized searches.

- Characteristics

FVF comprises up to 20 data fields for a total number of 231,116 records under the flag category considering every duplication. Main key data fields correspond to vessel identification and sources of information. Data about dimensional characteristics (length and tonnage) can be found along with authorization data. Historical vessel information on the same data fields is also available. Although a large number of records is available thought the FVF, there is no assurance of the authenticity of each vessel or duplicates. Thus it cannot give a precise estimate of the total number of vessels in each category.

The High Seas Vessels Authorization Record (HSVAR)

(7-13 data fields)

- Description

The High Seas Vessels Authorization Record (HSVAR) was brought to light under the umbrella of the requirements defined in Article VI of the Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas, in 1993 (also known as the FAO Compliance Agreement). In its Article IV titled "Records of Fishing Vessels", the Parties commit to maintain and ensure a record of fishing vessels entitled to fly its flag and authorized to be used for fishing on the high seas. With respect to that record, on Article VI the Parties agreed to exchange information periodically through FAO and provide 7 data types for the HSVAR as well as another 6 data types to the extent possible. This information comprised basic identification vessel´s data, ownership and characteristics and other optional information regarding operator´s data and other further characteristics.

To this end, the FAO throughout a circular letter (G/fi-24/PR) in October 1995, communicated the development of a prototype database and urged for participation of

the Parties, having participated five ratifying States. In April 2003, the Agreement entered finally into force and Parties were requested now to commit with Article VI (second Circular State Letter (G/X/FI-30).

- Characteristics

The HSVAR is not for public use, it is restricted to the Parties, although information can be distributed to global, regional and subregional fisheries organisations with the permission of the Party. Although it is applied to all fishing vessels that are used or intended for fishing on the high seas, vessels below 24 m of overall length may be exempted at the flag State´s discretion, provided that it doesn't undermine the purpose of the agreement.

Currently 43 Parties (including the EU with exception of Cyprus and Sweden, which joined the EU after accepting the Agreement) have ratified the FAO Compliance Agreement, giving the total of 60 flag States from which, just 40 submitted vessel data into the system at any given time. The number of vessels submitted to the HSVAR at this day, reach the figure of 6334 vessels, of which 25% correspond to the flag State of Japan and 43% to EU (13% to Spain).

The information requested to all Parties include the following seven required fields: (a) name of fishing vessel, registration number, previous names (if known), and port of registry; (b) previous flag (if any); (c) International Radio Call Sign (if any); (d) name and address of owner or owners; (e) where and when built; (f) type of vessel; (g) length. As well as to the extent practicable, the following additional 6 data fields: (a) name and address of operator (manager) or operators (managers) (if any); (b) type of fishing method or methods; (c) moulded depth; (d) beam; (e) gross register tonnage; (f) power of main engine or engines.

While the FAO Compliance Agreement is recognized for its potential to improve the degree of flag State responsibility, this potential is largely unrealized due to many aspects. Its legal nature of binding agreement may have discouraged countries' participation, resulting on a low number of ratifying States and thus, a limited effect and financial support. As a consequence, the record development and maintenance was then hampered by the lack of political and economic support, cooling down its implementation. Furthermore, the restricted access imposed by the Compliance Agreement, limiting the use and sharing of data only for all the Parties hindered the promotion and implementation of the HSVAR. At last, other elements as no harmonized data fields and units, use of private data, incomplete record submissions, as well as the fact that initially the use of UVI numbers for vessel traceability was not planned, weakened its purpose and required further efforts to adapt it in a time where countries engagement was at low levels (FAO 2008. Expert Consultation on the Global Record).

6.2. Regional registers

The Tuna Consolidated List of Authorized Vessels (CLAV)

(32 data fields)

- Description

In 2007, at the first joint Tuna Regional Fisheries Management Organizations (TRFMO) meeting, held in Kobe (Japan), the five TRFMOs joined forces enhancing cooperation amongst them:

- Commission for the Conservation of the Southern Bluefin Tuna (CCSBT)
- Indian Ocean Tuna Commission (IOTC)
- International Commission for the Conservation of Atlantic Tunas (ICCAT)
- Inter-American Tropical Tuna Commission (IATTC)
- Western and Central pacific Fisheries Commission (WCPFC)

As a result, the TRFMOs agreed on the unification of their authorized lists and IUU lists of vessels. The tuna Consolidated List of Authorized Vessels (CLAV)[17] became a harmonized list of tuna fishing vessels, "as comprehensive as possible (positive list) including use of a permanent unique identifier for each vessel such as an IMO number". The CLAV first publications started from 2009 (FAO 2007.TRFMOs). An important milestone in its further development, took place in 2010, with the First Workshop on Exchange of Information and Maintenance of the Consolidated List of Authorized Vessels of Tuna Regional Fisheries Management Organizations, where it was agreed the use of an exchange template, the update frequency and the inclusion of IMO numbers, as well as the use of a system-software developed by FAO.

- Characteristics

The CLAV list analyzed in this study corresponds to the version available by 21st of June 2017 and the monthly report of the CLAV corresponding to April – May 2017. In this CLAV list, tuna vessels currently accounts for 44.037 units, with about 7.507 vessels with IMO numbers and 3.563 vessels defined as support vessels, fish carriers, bunkers and motherships. The fleet is described by means of 32 data fields that include the IMO number and the Tuna Unique Vessel Identification number (TUVI) established by the T-RFMOs and adapted to the CLAV. The information is organized mainly over identification data information and authorization's validity, including also some dimen-

[17] The tuna Consolidated List of Authorized Vessels information system can be found at: http://clav.iotc.org/browser/search/#.WW4Yr4SGOUk

sional characteristics (just tonnage and length, as the minimum information needed for phase analysis).

It is important to consider that the sources of the data are the flag States, that provide their regional body with their fleet's data considering each RFMO's minimum inclusion criteria. Thereby, ICCAT's requirements for its authorized vessel list comprehend vessels of 20m and above, whilst others as IOTC request its Contracting Parties to provide all vessels larger than 24 meters in length overall, or in case of vessels less than 24m, those operating in waters outside the economic exclusive zone of the flag State.

Southeast Asian Fisheries Development Center (SEAFDEC)[18]

(5 data fields)

- Description

The Southeast Asian Fisheries Development Center (SEAFDEC) is a regional fisheries organization (RFMO) established in 1967. The mandate of SEAFDEC is "to develop and manage the fisheries potential of the region by rational utilization of the resources for providing food security and safety to the people and alleviating poverty through transfer of new technologies, research and information dissemination activities". SEAFDEC comprises 11 Member Countries: Brunei Darussalam, Cambodia, Indonesia, Japan, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Vietnam. The SEAFDEC headquarter is located in Thailand.

- Characteristics

The compilation of fishery statistics in Southeast Asia has been regularly pursued by SEAFDEC from 1978 to 2007 in the form of the "Fishery Statistical Bulletin for the South China Sea Area". Since 2008, revisions of the statistical framework in order to better assist its members and improve compilation by establishing minimum requirements concluded on the production of the new "Fishery Statistical Bulletin of Southeast Asia", reflecting the harmonized fisheries statistical framework and system of the Southeast Asian region.

The databases of the SEAFDEC entailed many different aspects of fisheries assessment, building nine different databases that goes from Fishery Production (distinguishing between inland and marine production) to fishermen statistical information, fishing gears, etc.

From 2008, fishing vessels related statistical information is publicly available till 2014. Whether vessels are motorized or not, fishing gear and length distribution can be found as main categories established for data collection along with the respective geographic sub area. A total of 5 main data fields including objective species are provided.

[18] Official website in: http://map.seafdec.org/fisherybulletin/Statistics/index.php

Central America Fisheries and Aquaculture Organization (OSPESCA)[19]

(11 data fields)

- Description

The Central American Fisheries and Aquaculture Organization (Organización del Sector Pesquero y Acuícola del Istmo Centroamericano, OSPESCA) is an intergovernmental organization that aims to encourage the development and the coordinated management of regional fisheries and aquaculture activities, helping to strengthen the Central American integration process. It comprise eight different country members: Belize, Costa Rica, Dominican Republic, El Salvador, Guatemala, Honduras, Nicaragua and Panama.

- Characteristics

An interactive database comprising 11 different data fields is offered in the online record built by OSPESCA. The data fields include basically the name of the vessel and national number as identification fields (no IMO number data field), dimensional and physical characteristics, place and date of construction and its operability. Of all its members, just five out of eight are displayed on the online record of fishing vessels, not being possible to observe any fleet detail of Belize, Costa Rica and the Dominican Republic. All the records belonging to El Salvador, Guatemala, Honduras, Nicaragua and Panama accounts for 564 vessels in total.

The Pacific Islands Forum Fisheries Agency (FFA)

(41 data fields)

- Description

The Pacific Islands Forum Fisheries Agency (FFA) is an advisory body created in 1979, to support and strengthen national capacity, providing expertise and technical assistance for the conservation and management of living resourses, in particular tuna and tuna-like species.

Based in Honiara, Solomon Islands, FFA's 17 Pacific Island members are Australia, Cook Islands, Federated States of Micronesia, Fiji, Kiribati, Marshall Islands, Nauru, New Zealand, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu and Vanuatu. The area covered comprehends all the seventeen member's EEZs.

- Characteristics

The register of vessels included in the FFA, only encloses those vessels fishing for high migratory species as tuna and tuna-like species, inside members' jurisdictional waters. Its database include two different list of vessels. On one side, the list of vessels in good

[19] For further information, official website: http://www.sica.int/ospesca

standing with current provisions, form by 1210 vessels with 41 different data fields provided. On the other side, the list of vessels licenses, with all the relevant data associated displayed on 10 data fields only reported by Vanuatu, Tuvalu, Solomon Islands, Papua New Guinea, Nauru, US Treaty. The information system of the FFA is very complete including vessel positions, compliance information, vessel history, authorizations, etc.

South Indian Ocean Fisheries Agreement (SIOFA)

(19 data fields)

- Description

The South Indian Ocean Fisheries Agreement (SIOFA), is a non-tuna Regional Fisheries Management Organization which complements the coverage of international resources in the South Indian international waters between Eastern Africa to Western Australia. It was signed in July 2006 in Rome by nine Contracting Parties: Australia, the Cook Islands, the European Union, France (on behalf of its Indian Ocean Territories), Japan, the Republic of Korea, Mauritius, the Seychelles and Thailand. Other countries that are signatories but have not ratified the Agreement are Comoros, Kenya, Madagascar, Mozambique and New Zealand.

The Agreement aims to enhance cooperation between the Contracting Parties in the Area in order to ensure the long-term conservation of its fishery resources and their sustainable development. The species targeted include fish, molluscs, crustaceans and other sedentary species, excluding highly migratory species and sedentary species under the jurisdiction of Coastal States.

- Characteristics

The SIOFA Record of Authorized Vessels, is a list of fishing vessels including 19 different data fields. Among the relevant information compiled could be pointed out the use of identifiers as IMO number (not mandatory for the RFMO), as well as the inclusion of historical fields as previous name and previous flag. Dimensional characteristics include length, tonnage and fish hold capacity. As it is a list of Authorized vessels, authorized period is included on the record as another data field.

South East Atlantic Fisheries Organization (SEAFO)

(7 data fields)

- Description

The South East Atlantic Fisheries Organization (SEAFO) is another non-tuna Regional

Fisheries Management Organization, born with the objective of achieving the long-term conservation and sustainable management of the fishing resources of its area of regulation.

The Convention Area covers the high seas of the South East Atlantic Ocean, bordered to the east by SIOFA and to the south by CCAMLR. The fisheries resources managed by SEAFO include fish, mollusks, crustaceans and other sedentary species, excluding highly migratory species and sedentary species under the jurisdiction of Coastal States. The Convention was signed in April 2001 by Angola, the European Community, Iceland, Namibia, Republic of Korea, Norway, United Kingdom, South Africa and the United States of America.

- Characteristics

The Authorized Vessel List hosted by SEAFO, is a simple list of vessels comprising 7 data fields that includes identification information as the IMO number, vessel type information, and basic dimensional characteristics like length and gross tonnage. Coastal States operating are Namibia and South Africa, that share resources with foreign nations as Japan, South Korea and Spain. All vessels recorded are big size vessels, rather industrialized.

South Pacific Regional Fisheries Management Organization (SPRFMO)

(4 data fields)

- Description

Complementing the advisory body known as Pacific Islands Forum Fisheries Agency (FFA), the South Pacific Regional Fisheries Management Organization (SPRFMO), is a non-tuna RFMO centered in the appliance of ecosystem approach to fisheries with the objective to ensure is long-term conservation and sustainability. The SPRFMO Convention applies to the high seas of the South Pacific and manages demersal and pelagic species (excluding tuna). Signatory members are numerous and comprise: Australia, Chile, China, Cook Islands, Cuba, Ecuador, European Union, Denmark, Republic of Korea, Vanuatu, New Zealand, Peru, Russian federation and Taiwan Province of China.

- Characteristics

The record of vessels active maintained by the SPRFMO, is mainly a list renewed every year of vessel names accompanied by other three categories, flag of the Member country or Non-Contracting Party, targeted specie and vessel type. This organization also have an IUU list with more complete information about vessels involved or supporting IUU fishing activities, that commonly refer about vessels fishing in the Convention Area without been authorized.

IUU Lists

- Description

With the aim to prevent, deter and eliminate IUU fishing in international waters under the regulation of RFMOs, the main RFMOs established the well-known IUU lists. Those lists of vessels, gathered vessels sighted and caught performing or supporting fishing related activities in contravention of the conservation and sustainable management efforts agreed by the RFMO's contracting parties in their own or adjacent convention areas. The objective of those lists was to raise awareness about vessels and operators that incurred in IUU fishing in order to alert coastal, port and market authorities for taking action against them.

The IUU vessels lists then possess fishing vessel statistical information that could be used in the analysis of possible general trends that could be common in IUU vessels. Of utmost importance for this analysis would be the minimum length, most common length classes, etc. Data is provided by nine RFMOs, that are:

— Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR)
— Inter-American Tropical Tuna Commission (IATTC)
— International Commission for the Conservation of Atlantic Tunas (IC-CAT)
— Indian Ocean Tuna Commission (IOTC)
— Northwest Atlantic Fisheries Organisation (NAFO)
— North East Atlantic Fisheries Commission (NEAFC)
— South East Atlantic Fisheries Organisation (SEAFO)
— Western and Central Pacific Fisheries Commission (WCPFC)
— South Pacific Regional Fisheries Management Organisation (SPRFMO)

- Characteristics

The IUU vessel lists generally show the basic identification information fields of vessels such as vessel's names and name history, flag and flag history, IMO number, IRCS, vessel type, owner and operator information, in addition with other dimensional characteristics such as overall length and tonnage. All these fields provide a static image of those IUU vessels included, which can be easily outdated by the operators through an online reflagging and renaming operation to hide their activities. Nevertheless, although that few if any of the vessels listed might maintain the identity with which they were listed with, to study and compare the physical characteristics of IUU vessels, these lists are of great value.

European countries' national registries and the EU Fishing Fleet Register

(38 data fields)

- Description

The Community Fishing Fleet Register[20] in contrast with the previous registers mentioned, possess some accentuated particularities that makes it different. The Community Fishing Fleet Register, instead of a Regional Register should be considered as a compilation of National Registers that is later disseminate into a single vessel record. The EU Fishing Fleet Register was born in 1989[21], as a comprehensive database of all fishing vessels flying the flag of a European Member State. At the time, it was built to help with the assessment, management and implementation of structural measures where financial support was provided to the fisheries industry. Over the years, the Community Fleet Register evolved, becoming a source of information not just for managing fishing effort and monitoring purposes of the implementation of capacity management measures, but also as a reliable source of information of statistical data and for Member State´s authorities responsible for control and inspection activities. One of the most significant amendments, took place on 2002, with the adaptation of the Community Register to the standards set on the Agreement to promote compliance with international conservation and management measures by fishing vessels on the high seas[22]. In order to achieve a sufficient reliability, from September 2004, Member States shall update quarterly the information given to the EU Fleet Register[23]. In the next few months, new software developments employing web services will allow instantaneous updating of the register whenever the statistical information of a vessel is updated in a European country member.

- Unique identification number

For tracking purposes and in order to identify fishing vessels in a unique way, already in 1998, an internal number was created; a unique identification number given by the Member States to each fishing vessel registered on the Member State´s census and for vessels registered for the first time after the adoption of the internal number[24].

Later called Community Fleet Register identification number (CFR), in 2004, the CFR is composed of the Alpha-3 ISO code of the flag State, followed by an identifying series of nine characters. It was meant to remain permanent, not altered or reassigned, even for vessels exported to another Member State, scrapped or withdrawn from fishing[25]. Nevertheless, those measures have proven not to be sufficient. European vessels with CFR

[20] Although in principle "Community" changes to "EU" post-Lisbon, in this case CFR ("Community fleet register") appears to remain unchanged

[21] The EU Fleet Register was established by the Commission on its Regulation (CE) No 163/89 of 24th January 1989.

[22] Regulation (EC) No 839/2002 amended on May 2002 Regulation 2090/98 concerning the fishing vessel register of the Community.

[23] Regulation (EC) No 1799/2006 amending Regulation (EC) No 26/2004 on the Community fishing fleet register.

[24] Defined in the Annex I of the Commission Regulation (EC) No 2090/98 concerning the fishing vessel register of the Community.

[25] Article 10 of the Commission Regulation (EC) No 26/2004 on the Community fishing fleet register.

numbers could reflagged to a non-EU country and reflagged back again to a EU country without acknowledgment, receiving a new CFR number and creating duplications in the dababase. Aware of these facts, recently the European Commission drafted a new implementing regulation proposal on the union fishing fleet register by 19th September 2016, stating that; "The CFR number shall not be reassigned to another vessel. If a fishing vessel is exported outside the Union and re-imported back into a Member State, the fishing vessel shall be reassigned the same CFR number". Even though this intends to avoid duplications, it does not allow to track vessel activities given that the CFR number must be included in all transmissions of data between the Member States and the Commission, but not when flying a non-european flag.

- Characteristics

Currently, the European Fleet Register comprised 83.386 vessels with different CFR numbers assigned. Other identification fields collected such as vessel name, external marking and IRCS display different total number of vessels, may be due to the fact of not being unique and their reassignment after scrap or deregister from the list.

The data contained for any vessel consist on a set of 38 data fields that can be classified into four different groupes:

Table 3: EU Fishing Fleet Register data fields

Identification and registration	Dimension	Historical	Ownership
CFR, vessel name, port, external marking, IRCS, gear type, etc.	length, tonnage, power, fishing gear, etc.	entry into and exit from the fleet, modifications of characteristics.	agent and owner´s name and address

Although this database covers most of the data fields required for the Global Record, some important fields as the IMO – UVI number are not stored and displayed at the moment. Nevertheless, the European Fleet Register is updated on a quarterly basis and includes detailed information about any vessel registered on an European Member State. In the case of gear type for instance, 29 different gear categories are provided.

Due its updated status and the importance of the European Union either as international fishing power and market for fish products (first world's fish importer), its Fleet Register constitutes a valuable source of information for analysis.

6.3. Other records

Questionnaire to the countries

- Description

A first look at the data accessible on the information systems aforementioned, reveals many deficiencies in length overall distributions and overall numbers for the fleets of many relevant countries. In most of the cases, those gaps are related with poor reporting over the last years due to a lack of participation and awareness of its importance. This poor data sharing demotivation leads also in some cases to non-detailed description of their fleets in the surveys, resulting in poor knowledge on length classes distribution knowledge and the impoverishment of the world's fleet assessment. Other possible explanatory causes are promoted by decentralized registers or at the very least, the absence of registries at all, making technical assistance and capacity development activities for the implementation of the Global Record essential and necessary to consider in a complementary study to analyze the viability as well.

In an attempt to address this fleet gap, a questionnaire was built to complete and gather the last pieces of the puzzle in order to build the best picture of the world's fishing fleet (Annex II). This questionnaire addresses FAO member countries focusing on the characteristics of their fleets, such as length distribution according to phases 2 and 3 of the Global Record or number of vessels authorized to fish in the High Seas, as well in neighboring EEZs.

- Characteristics

For the questionnaire, a large database of authorities´ email contacts of more than 700 addresses from all the FAO Members (194) and other dependencies (Faroe Islands, Niue and Cook Islands) was built. Addressees were derived from FAO Ministerial lists and Permanent Representatives, last Committees on Fisheries held, international conferences, working groups and specialized core groups attended by national fisheries experts during the last years.

The platform used for launching the questionnaire was the website named "Survey Monkey", specialized in creating and conducting online queries. Easy to fill and submit, as well as user-friendly, the Survey Monkey website application was meant to enhance participation and then increase submissions of Members, generally very reluctant to accomplish with any other extra duty suggested.

Global Integrated Shipping Information System (GISIS)

(11 data fields)

- Description

With the purpose of creating an online, centralized system for data collection, processing and publishing, the International Maritime Organization (IMO) developed GISIS[26] to fight sub-standard shipping in an effort to improve maritime safety and quality, security and preventing pollution. Member States and intergovernmental organizations were urged to use GISIS for the reporting and transfer of data into the system, to end with disparate off-line databases manually distributed in circular letters and also to harmonize data submissions[27].

Later on, having showcased the value of GISIS as an effective way of notifying reporting obligations, the information system of IMO was proposed for further development (Assembly Resolution 1074) reaching our present days with its extension to the fishing fleet possessing IMO numbers as well.

- Characteristics

Feed by IMO Members and IHSM&T, GISIS contains all vessels with IMO Numbers (including fishing vessels). However, the information that it disseminates comprises only 11 different data fields. Regarding vessel type data field, categories for fishing vessels are just divided into:

  - Fish Catching: stern trawler factory, fishing vessels

  - Other fishing: including fishery research vessel, fishery support vessel, fishery patrol vessel, fish carrier, fish factory ship, fish farm support vessel and fish storage barge, non-propelled.

GISIS, does not allow like other systems, the download of full datasets of information. Only consulting a vessel at a time.

Global Fishing Watch

- Description

The Global Fishing Watch is a project launched by Google in partnership with Oceana and Skytruth, during the Our Oceans Conference of 2016. It uses a big data technology platform that leverages satellite data based on the Automatic Identification System (AIS) network. The platform works by analyzing the data points from AIS deriving fish-

[26] (https://gisis.imo.org/Public/SHIPS/Default.aspx)

[27] Established on the IMO Resolution A.1029(26) Global Integrated shipping Information System (GISIS)

ing vessel's behavior through identity, speed and direction data to determine the type of ship, fishing gear, and fishing locations of each vessel on an interactive map.

This initiative is meant to increase awareness of fisheries and influence sustainable policy by improving decision-making and effective management through transparency, enabling the general public to see in space and time the intensity of fishing activity and track commercial fishing vessels around the world for free. Global Fishing Watch counts with the support of the satellite company Orbcomm, that provides three day old data, described as "near real-time" along with historical records.

- Characteristics

Global Fishing Watch through vessel's AIS positions unveil the activities of 200.000 vessels all around the globe, offering complementary information for better understanding as exclusive economic zones, marine protected areas and other features.

Data are shown with three days of delay including historical information. Valuable for analysis and assessment but not relevant for surveillance and simultaneous control activities. Soon will be complemented with animal behavior through tagging of big migratory species, what could contribute to reduce discards of certain sensible species.

The Combined IUU Vessel List of Trygg Mat Tracking (TMT)[28]

(30 data fields)

- Description

Trygg Mat Tracking (TMT) is a not-for-profit organization based in Norway, that provides technical support to fisheries enforcement agencies or national fisheries authorities and international organizations, by means of fisheries intelligence analysis. One of the tools offered by TMT is the Combined IUU list of vessels.

- Characteristics

The Combined IUU list of vessels is a public information system that compiles and disseminates all the vessels published on the IUU lists aforementioned, relative to the nine main RFMOs and the INTERPOL Purple Notices. This list have the particularity of providing an up to date record of the vessels included in the IUU lists without losing those that have been now delisted. The list offers 30 data fields that includes major identification information such as vessel's names and name history, flag and flag history, IMO number, IRCS, vessel type, RFMO and RFMO history, owner and operator information and history, in addition with other dimensional characteristics such as length overall, tonnage, depth and deadweight.

[28] More info on the tool's website: http://iuu-vessels.org/iuu

III. METHODOLOGY

To discuss the feasibility of considering more or less fishing vessels on the Global Record and to answer the question about which would be in case the most appropriate length overall to establish as minimum requirement, three principal criteria were selected. On one side, to understand the extension in terms of vessel numbers on each of the phases described for the Global Record, the total number of fishing vessels at global level was considered. On the other side, due to the fact that IUU fishing activities are perpetrated in its biggest extent in waters were high productivity of commercial species can be found and generally there is no effective fisheries management and strong patrol surveillance capacity (Petrossian, G.A., 2015), the fishing fleet operating on international waters (High Seas) and Neighboring EEZs was studied. Finally, to discussing the results with real cases, all vessels included on the IUU lists shared and maintained by the main RFMOs were analyzed.

Criteria 1

Calculating the total number of fishing vessels included in each of the phases defined for the Global Record will allow to understand the magnitude of the global fleet and its phases, as well as their interrelations or relative proportions. Furthermore, it will have a direct implication for IHSM&T, the company in charge of issuing the IMO numbers on behalf of the IMO. Depending on their operational capability the number of vessels entering the Global Record Information System constitute a relevant criteria that will determine the feasibility of the project at his earliest stage, as the IMO number is the essential data field.

In an attempt to achieve the best estimated figures on the global fishing fleet and its distribution on length overall classes, a methodology that could integrate the different sources of information and minimize the loss of reliability was considered. Taking into account that the most reliable and accurate data source is the one coming from the own flag States that generate the information, as primary sources. The first approach was to take as starting point and pillar database for the study, owing to its importance and uniqueness, the statistical data collection of FIAS throughout the FF1 and FF2 questionnaires (Annex I) built during more than 60 years. These two questionnaires as previously explained are annually sent to flag States, expecting them to report their fleet statistics related to the previous year. Information then flows, directly from flag States with the advantage that data fields included contemplate the same length distribution set up for the current Global Record.

Although the questionnaires quantitatively are very complete, some inconvenient rapidly emerge associated to them. To begin with, there is no qualitative distinction on aquaculture, inland and marine fishing vessels, incorporating an inherent error on the figures. Furthermore, important gaps of information resulting from bad or non-reporting of States deeply impoverish the FAO database from one side, entailing the incorporation of estimated figures in some cases to show consistency. In addition, the delay associated

to the procedures, unveil that files available with the most up-to-date reported data, correspond to the years 2013-2014.

Thus, for the first criteria studied, some assumptions were undertaken. For instance, to minimize the inherent error associated with aquaculture and continental fisheries, landlocked countries were only specially considered for the study when possessing maritime fishing fleet or when acting as one of the Open Registries[29] recognized by the International Transport Workers' Federation, ITF (Table 3), excluding the rest of inland countries from the analysis.

Table 4: Open Registries as the ITF

Flag	Total Number of Vessels	Foreign Vessels	% Foreing Vessels/ Total	Paris MOU List
Antigua & Barbuda	1257	1215	96.66	White
Bahamas	1160	1069	92.16	White
Barbados	109	83	76.15	White
Belize	247	152	61.54	Black
Bermuda (UK)	139	105	75.54	White
Bolivia	18	5	27.78	-
Cambodia	544	352	64.71	Black
Cayman Islands	116	102	87.93	White
Comoros	149	73	48.99	Black
Cyprus	838	622	74.22	White
Equatorial Guinea	5	1	20	-
Faroe Islands	37	28	75.68	White
French International Ship Register (FIS)	162	50	30.86	White
Georgia	142	95	66.9	-
German International Ship Register (GIS)	427	6	1.41	White
Gibraltar	267	254	95.13	White
Honduras	88	47	53.41	-
Jamaica	14	14	100	-
Lebanon	29	2	6.9	Grey
Liberia	2771	2559	92.35	White
Madeira	109	81	74.31	-
Malta	1650	1437	87.09	White
Marshall Islands	1593	1465	91.96	White
Mauritius	4	0	0	-
Moldova	121	63	52.07	Black

[29] This table shows the Flags of Convenience as declared by the International Transport Workers' Federation (ITF) along with complementary information from the Central Intelligence Agency, dated on January 2017

Mongolia	57	44	77.19	-
Myanmar	29	2	6.9	-
North Korea	158	13	8.23	
Panama	6413	5157	80.41	White
Sao Tome and Principe	3	2	66.67	-
Sri Lanka	21	8	38.1	-
St. Vincent	412	325	78.88	Black
Tonga	7	2	28.57	-
Vanuatu	77	72	93.51	Grey
Netherlands Antilles				-

In addition, as a general procedure, aware of the constant evolving status of the global fleet that shows a descendent general trend in rough numbers mainly in developed countries, with particular exceptions of some countries that conduct expansionist policies to develop its distant water fishing fleets, the data pursued was the most updated available. However, in a few cases where data from the years encompassed between 2012-2014 was not accessible, vessel data till 2009 was accepted assuming no variations on fleet numbers. Greater errors in total numbers will be derived in the cases where no data is available based on the assumption that the fleets do not suffer major changes in numbers in few years' timespan.

For this very reason, as a second approach, in order to complete and improve the reliability of the data, other relevant sources of data were considered, subjected to the condition of coming from the primary sources mentioned and being the most updated possible. Under this category we have used the last FAO Yearbook for 2014, the EU Fleet Register, HSVAR (for Phase 1) and the questionnaires. Some other data sources supplied by flag States, although with no responsibility on its reliability, as Regional Fisheries Organizations like the Pacific Islands Fisheries Forum Agency (FFA), the Southeast Asian Fisheries Development Center (SEAFDEC), the Tuna Consolidated List of Authorized Vessels (CLAV) or the Central America Fisheries and Aquaculture Organization (OSPESCA) have been assessed and considered in those cases where the gaps were insurmountable. At last, for further clarifications, sources not official or certified by flag States as the Fishing Vessel Finder, or related to Monitoring Control Systems, like the AIS data provided by Global Fishing Watch were used for discussion and cross-checking of results.

Criteria 2

To determine which segments and proportions of the fleet carry out fishing activities on distant fishing grounds, another of the criteria considered is their access to High Seas and Neighboring EEZs. The importance of this criteria lies on the relevance of IUU fishing on international waters. Operators of countries with developed fishing industries and markets, usually affected by overcapacity and overexploitation of their national resources, on their search of more profitable locations leave for new fishing grounds

outside their national waters. Operators, by developing long distant waters fleets with high fishing capacity, allows these coastal countries, to reduce the fishing effort on national waters while continuing expanding their fishing industry and economy. However, the fishing effort is simply transferred to other fishing grounds where they will have to compete with other foreign fleets. In the case of the High Seas, some of this fishing vessels, to hide their activities from the control of their flag States, reflag in Open Registers to realize illegal and unregulated fishing. Others, through joint ventures or bilateral agreements, fish in neighboring EEZs where, the presence of international commercial species combine with lack of control and lack of effective management might open the gates to illegal fishing in the form of unreporting of catches, which can lead to the overexploitation of those stocks. Due to the impacts that this fleet can cause on the sustainability of the stocks and in socioeconomics terms for the coastal villages, this criteria arise as fundamental.

As a result, in order to gather information about fleet activities on High Seas and Neighboring EEZs the questionnaire developed, include both issues, associated to the phases established for the Global Record for its analysis. As countries are demanded in this questionnaire to specify the overall number of vessels included in each phase, length overall data is substituted by phase number.

The methodology used to build the contact list for the questionnaire was to retrieve e-mail contacts of national authorities from the FAO Ministerial lists and Permanent Representatives, last Committees on Fisheries held, last international conferences as the PSMA Conference in Oslo and regional working groups. In addition, other events or meetings organized by the Global Record team as the Global Record Working Groups or the Specialized Core Groups attended by national fisheries experts during the last years was also considered. The list resulting from the search compiled at that stage more than a thousand e-mail addresses, which were subsequently consulted to refine the list of final contact points from each region. This consultation served to derive the Member State's responsible e-mails for the national vessel register in many of the cases. As result for the questionnaire, a large database of authorities´ email contacts of more than 700 addresses from all the FAO Members (194) and other dependencies (Faroe Islands, Niue and Cook Islands) was built and prepared for launching the survey.

To complement this data, the HSVAR information system is consulted and crosschecked with the questionnaire. The final analysis and comparison of this criteria, will allow to determine where to establish a threshold for the minimum vessel requirement established in terms of length overall or tonnage, to optimize the operability of the Global Record without compromising its main objective of enhancing transparency and traceability.

Criteria 3

A third criteria was added in order to answer questions as whether all fishing vessels sighted performing or supporting IUU fishing in the areas under the convention of a RFMO follow a certain dimensional-based pattern that can be use as a criteria, the vessel types involved, fishing grounds affected, most attractive fisheries for IUU fishing activities, etc. The reality shows that answers to those questions are complex. IUU

vessels in their search of economic benefit, use to be related with high profit fisheries and this profitability relies on a wide range of variabilities that change depending on the commercial species targeted (or price), the fishing ground, the volume of the catches, costs and risks associated to the activity and other factors.

To simplify, in the search of a general answer based on real cases observed, bearing in mind the weaknesses stated, for this final criteria the information available on fishing vessels caught conducting or supporting IUU fishing was analyzed. Seeking with this analysis, to contribute to potentiate the discussion and extract valuable conclusions in the line of the objective pursued.

To this end, the IUU lists corresponding to the nine main RFMOs mentioned in the Chapter Material in addition with the INTERPOL Purple Notices and the Combined IUU Vessel List shared and maintained by Trygg Mat Tracking (TMT) were put together and analyzed for common patterns that could shed some light and encourage the discussion. The main assumption undertaken for this criteria was the representativeness of the vessels listed of the general IUU vessel reality. Nevertheless, there is no other similar official information at global level available.

IV. RESULTS AND DISCUSSION

It is worth mentioning, the challenging character of this study, that seeks to assess the global fleet of the 194 FAO Members, plus numerous overseas. As a result, a great effort was needed to get enough data for the analysis. In this Chapter of Results and Discussion, the three criteria presented have been elaborated over the next following points that try to englobe each of the results obtained during the analysis of the databases presented:

Table 5: Criteria results

Criterion 1	Criterion 2	Criterion 3
• Global Fleet analysis	• Questionnaires	• IUU Lists
• Vessel Type analysis	• Global Fishing Fleet on High Seas	• Purple Notices
• Automatic Information System (AIS) data analysis	• Global Fishing Fleet on neighboring EEZs	

7. Global Fleet Analysis

The study and analysis of the data aforementioned helped to build possibly one the most up-to-date and accurate image of the existing global fleet available today. In order to keep it as much reliable as possible, although assumptions were undertaken during the study, the fundamental source of the data has been always the flag States generating it and responsible for it. Only in those cases where gaps of information coming from the flag States existed and were unsurmountable, other methods and sources where used based on their reliability, respecting the methodology aforementioned to avoid an improper handling of the database constructed. Some of these alternative databases where the questionnaires where the data is directly provided by the Flag State itself and by RFMOs, where indirectly data is extracted from their databases filled by the Flag States participating to them.

In a first attempt to reduce complexity, an assumption applied was to exclude from the analysis, those Members States possessing only inland water fleets or no coastal line. This assumption was undertaken with great care based on the study of the national registries and the analysis of the fisheries and aquaculture country profiles produced by the FAO[30] on marine and aquaculture related sectors, such as the production sector, the post-harvest sector (fish utilization and market), the socio-economic contribution of the fishery sector and other relevant trends. This helped as well to reduce the error inherent to the non inclusion on the FAO database of any distinction between aquaculture and marine fleets. The overall total number of coastal States resulting was 163, bound together under eight different major regions: Africa, Asia, Oceania, Europe, North America, Central America and South America (Figure 1).

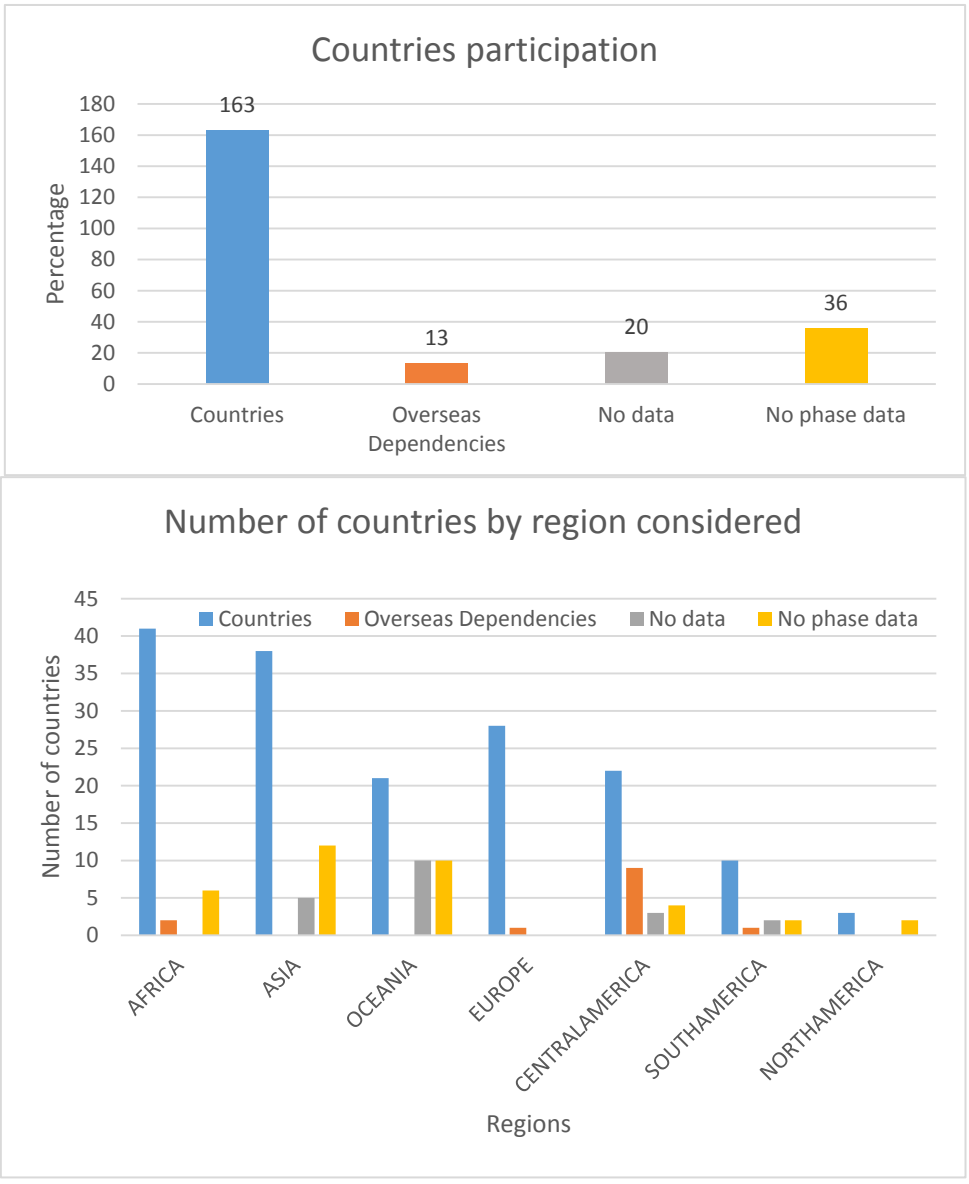

Figure 1: number of FAO Members and overseas dependencies analyzed

[30] To know more: http://www.fao.org/fishery/countryprofiles/search/en

Unfortunately, the vessel data reporting by some of these coastal States have many gaps. In some cases it was completely inexistent due in part to the lack or poor national registers, urging for technical support and capacity development missions on a later stage. Despite their relevant fleet numbers, in some other countries, only the total number of fishing vessels and not their length distribution was accessible (figure 1), hampering a phase distribution analysis. Some of these gaps were filled with the help of the questionnaire built and spread to every Member State of the United Nations. Nevertheless, the feedback was poor, only 20 countries answered. From these 20, some of them like Sudan, Somalia or Bosnia and Herzegovina do not have industrial fleet or fleet at all, others like South Korea sent it blank, and in some cases information from the previous sections was simply copied and pasted.

In total numbers of countries, 139 coastal States (85% from the total) and 13 overseas dependencies were analyzed, from which 127 coastal States (78% from the total) and 13 overseas dependencies were also studied by length distribution (Figure 1). In total numbers of fishing vessels, if the estimated figure by FAO of 4,6 million (SOFIA, 2016), for the total number of fishing vessels in 2014 is considered as the total global reference, despite it is believed to have increased to 4,7 million for the next SOFIA report of 2018. The fleet coverage of this study would then have achieved 89% of the total fleet, but just 40% involves fleets distributed by length and tonnage classes.

Table 6: regional representation in terms of countries

	% Representation
AFRICA	95
ASIA	87
OCEANIA	52
EUROPE	100
CENTRALAMERICA	82
SOUTHAMERICA	80
NORTHAMERICA	100

The areas or continents with the biggest reporting gaps correspond to Oceania and Asia (as can be seen in Table 5), followed by Central America and South America. Oceania low representativeness is due to the lack of data from its major members like Australia, Kiribati, Marshall Islands, Micronesia, Niue, Palau, Samoa, Solomon Islands, Timor-Leste and Tokelau. For the rest, despite that representativeness is high in general terms (over the 80%), significant uncertainties are associated to certain countries, particularly in the case of Asia (e.g. China) surpassing those gaps to Oceania's ones in relevance.

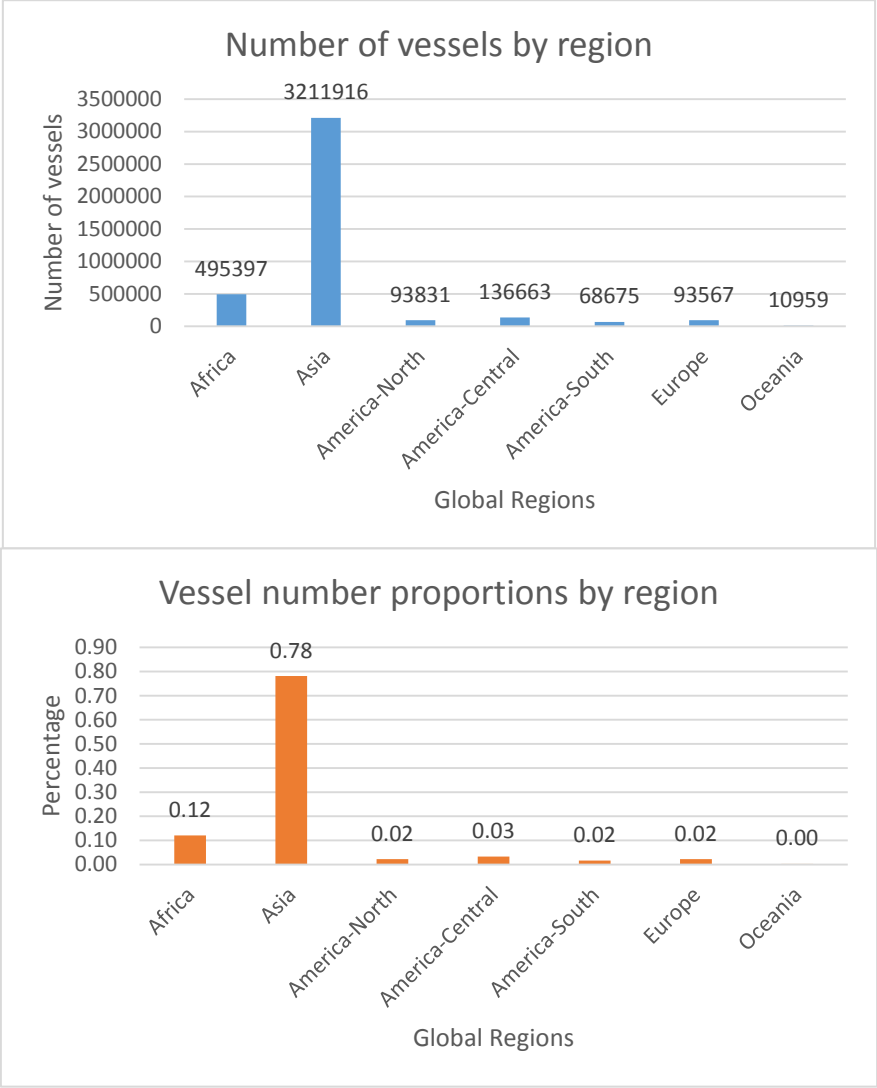

Figure 2: number of vessels per region

Representing approximately the 78% of the globe's fleet in number of fishing vessels (Figure 2), Asia's gaps of information can greatly disturb the results of any analysis. In this sense, also to avoid taken risky assumptions, for fleet phase distribution analysis, the Republic of Korea, Japan, China, India, Russia and Cambodia were excluded in the first place, explaining the lower figures obtained in figure 3, which represents the global fleet by segments.

As a consequence of the absence of those countries for the length segmented global fleet graph presented on Figure 3, a direct figure of the number of vessels cannot be derived from each phase. Although approximations can be made in order to calculate first which would be an acceptable common proportion or percentage for each of the phases based on other countries data and then extrapolate it to the Republic of Korea, Japan, China, India, Russia and Cambodia, it might not be recommended. Little differences in the proportions established can entail very significant changes on the global numbers by phase. The high vessel numbers of the fleets aforementioned would mean that even with

very low differences on the percentages assumed, thousands of vessels would be included or either excluded in the final figures.

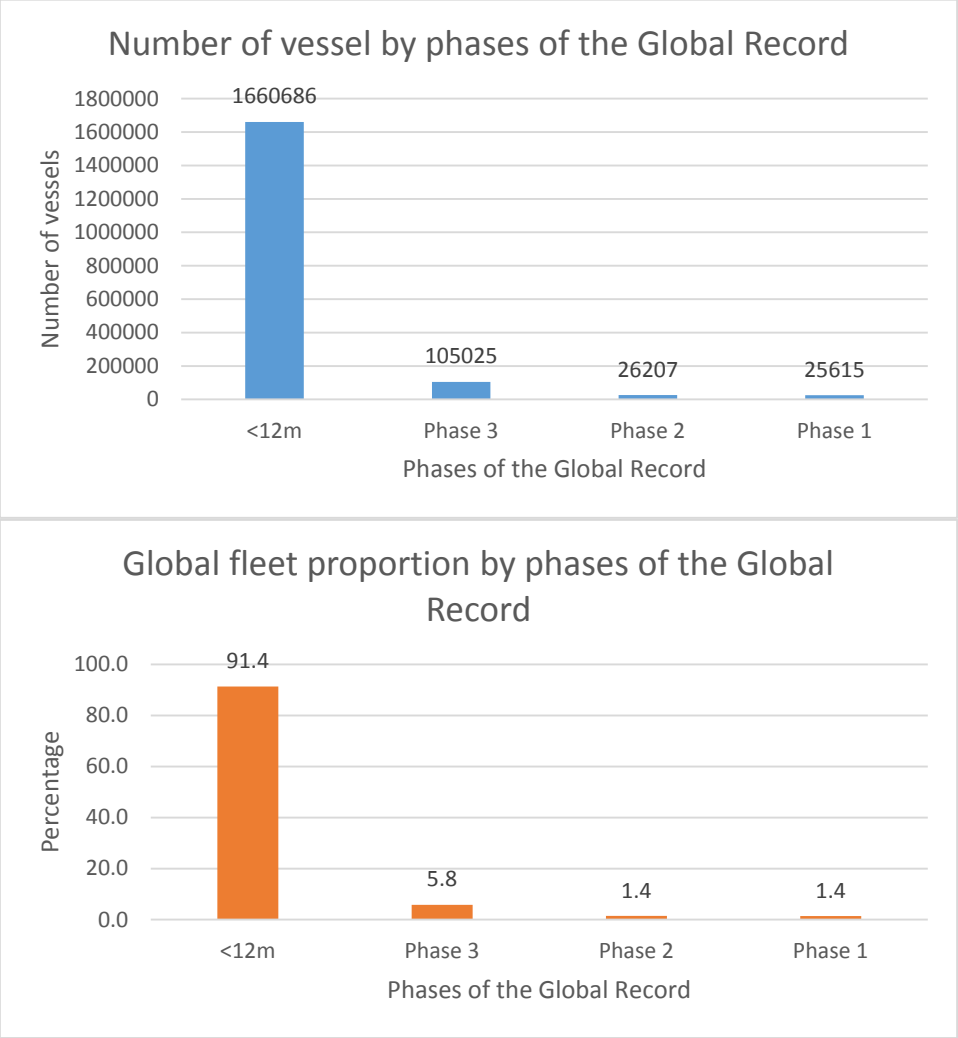

Figure 3: Global fleet by phases of the Global Record

Furthermore, every region follows its own pattern related with phase proportions (figure 4). Some of them depending on the commercial species of the area, type of fishing grounds, stage of development and fishing technology available, state of the coastal resources, etc., have developed big fleets in terms of numbers or in terms of tonnage, or both as many countries in Asia.

As a general overview, despite that by number only 40% of fishing vessels are analyzed by length and tonnage, as 78% of the countries present length and tonnage distribution data, data representativeness is acceptable. Regarding fleet numbers, they are registered largely in the Asian Region that comprehend approximately the 78% of the total global fleet, followed far behind by Africa, America, Europe and Oceania (Figure 2). Vessels under 12 meters length class clearly dominate the spectrum, representing about the 91,4%. In terms of size and tonnage, phase 1 accounts globally for the 1,4 %, being

more significant in Europe that in contrast with other regions have a larger representation of phases 2 and 3 as well, indicating a higher proportion of industrial fisheries. Africa, despite of their great numbers, possess a highly artisanal fleet, just the opposite case of Oceania, the less representative region characterized with few vessels of greater sizes (Figure 4).

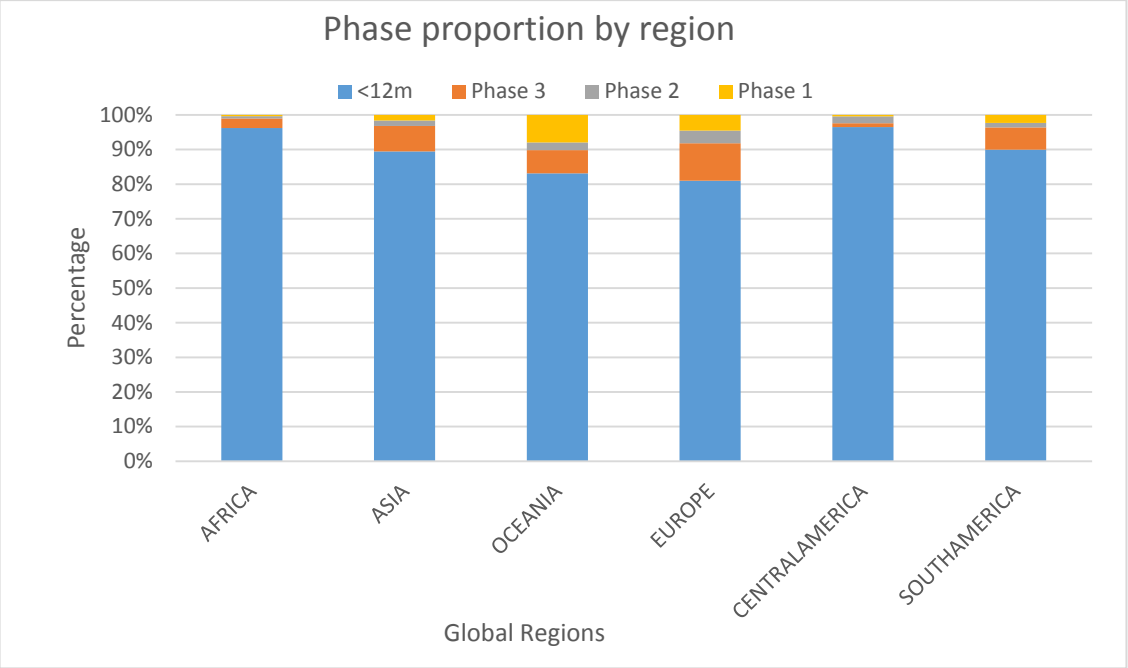

Figure 4: Phase % by continents

For the next points, to give an idea of the state of the fleets by regions, figures[31] introducing countries total number of vessels and total number of vessels by their length distribution will be attached. As a point for discussion, world vessel level of reporting, representativeness, regional fleet understanding is herein after analyzed with a short introduction on the main regional characteristics.

7.1. African region

The African region is characterized by environmental processes as the Benguela upwelling system which supports high productivity along the southwestern coastline. Other oceanographic events as major currents, upwellings and equatorial convergence, enriched by major rivers, conform high productivity areas in the northwestern part of the region that could supports large fleets (FAO, 2011b). These processes produce high diverse commercial species and as a consequence, an attractive fishing ground for for-

[31] In those cases where the number of countries per region does not allow to understand or have a clear view of the data presented, Figures are substituted by tables.

eign distant water fishing nations, as well as estimulates the investement of national operators.

The African region, possess the second world's region largest fleet and in contrast to Asia, mainly all countries' are highly represented within FAO database. Nevertheless, assumptions were taken in the case of Chad, Niger, Botswana, Burkina Faso, Burundi, Central African Republic, Ethiopia, Lesotho, South Sudan, Zambia, Mali and Zimbabwe that were not included for being inland countries.

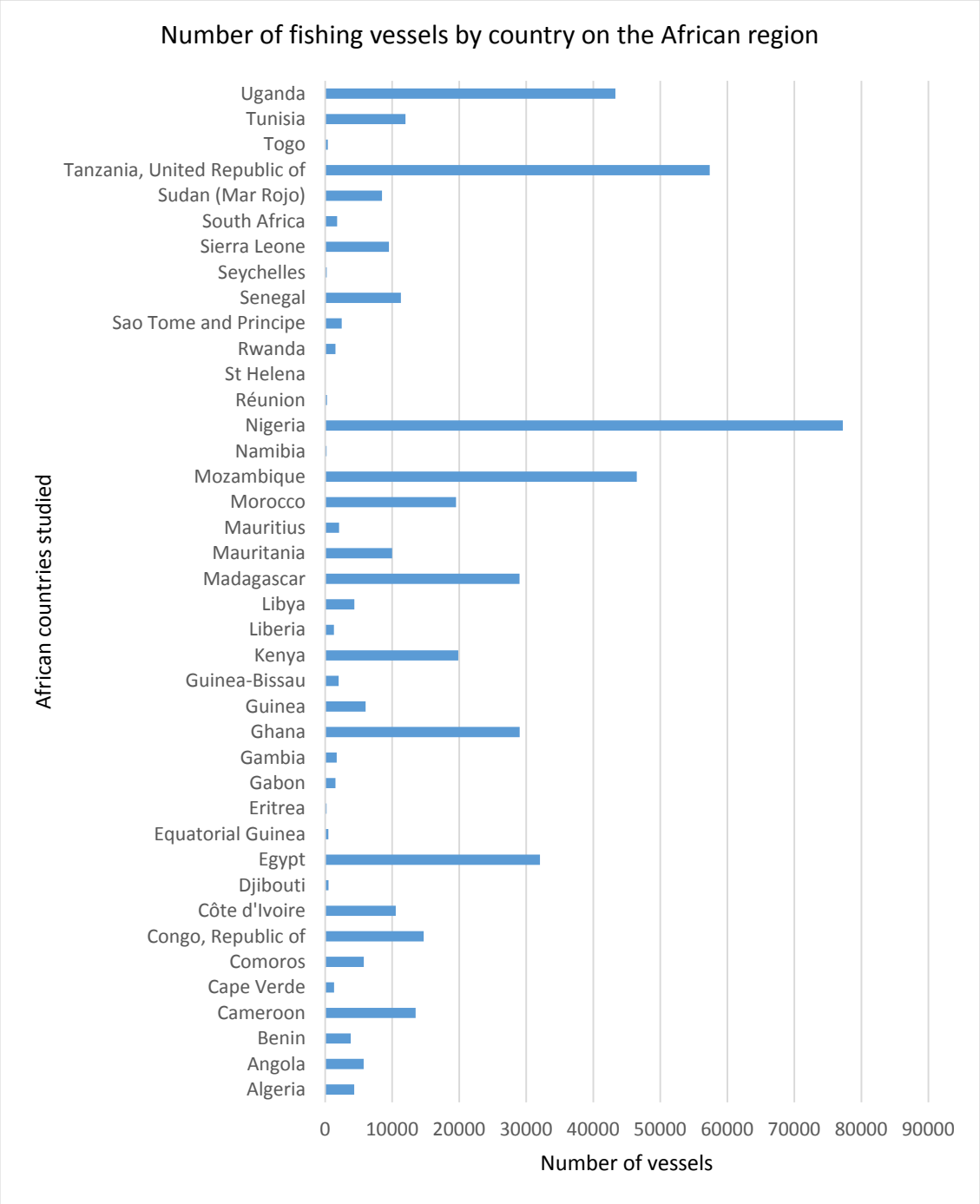

Figure 5: fleet distribution by country in the African region

As an exception, also a special case was excluded related with the biggest African fleet reported. This was the case of Democratic Republic of the Congo, which counts with only 37 Kilometers of coastal line but 200.036 fishing vessels. No relevant landing ports or infrastructures, no vessel registered in the South East Atlantic Fisheries Organization (SEAFO) that manage High Seas beyond its national Exclusive Economic Zone (EEZ) and large aquaculture production lead to the exclusion of Democratic Republic of the Congo from the study. Decision taken to avoid incurring on big reliability losses.

Table 7: African fishing fleet by length segments

AFRICA	<12m	Phase 3	Phase 2	Phase 1	Total1
Algeria	3000	1227	99		4326
Angola	6584	118	381	96	7767
Benin	52537	742	2	3	53284
Cameroon	11247	1424	7	53	12731
Cape Verde	1254	48	28		1330
Comoros	5755				5755
Congo, Republic of	14608	44	24	26	14702
Côte d'Ivoire	8812	677	1004	32	10525
Djibouti	476	20			496
Egypt	23799	2441			30828
Equatorial Guinea	359	113		1	473
Eritrea	127	41	14	31	213
Gabon	1000	484	18	44	1546
Gambia	1506	200	6	18	1730
Guinea	4700	1325		3	6028
Guinea-Bissau	2020			1	2021
Kenya	19268	588	4	8	19868
Liberia	1280		23	14	1317
Libya	2713	1325	163	161	4362
Madagascar	28820	18	24	100	28994
Mauritania[32]	10000 F	36	102	242	10000 F
Mauritius	2060	13	1	7	2081
Morocco	17139	510	1180	293	19122
Mozambique	46080	211	28	95	46414
Réunion	240	18	8	5	271
St Helena	22				22
Rwanda	1532				1532

[32] Figures marked with "F", are estimations made by FAO officials to address inconsistencies found based on historical series of countries data. Values for phases 3, 2 and 1 are derived from the questionnaire.

Sao Tome and Principe	2419	24			2473
Senegal	8738	11	16	86	8851
Seychelles	181	10	1	32	224
Sudan (Mar Rojo)	8484				8484
Tanzania, United Republic of	56985			36	57021
Togo	236	157	8		401
Tunisia	10660	681	373	237	11981
Uganda	42695	592	3	3	43293

Without Democratic Republic of the Congo, in the African country, Nigeria, Tanzania and Mozambique stand up as the biggest fleets of the continent (Figure 5) in number, possessing the North African countries like Mauritania, Morocco and Tunisia the most industrialized fleets with bigger tonnages.

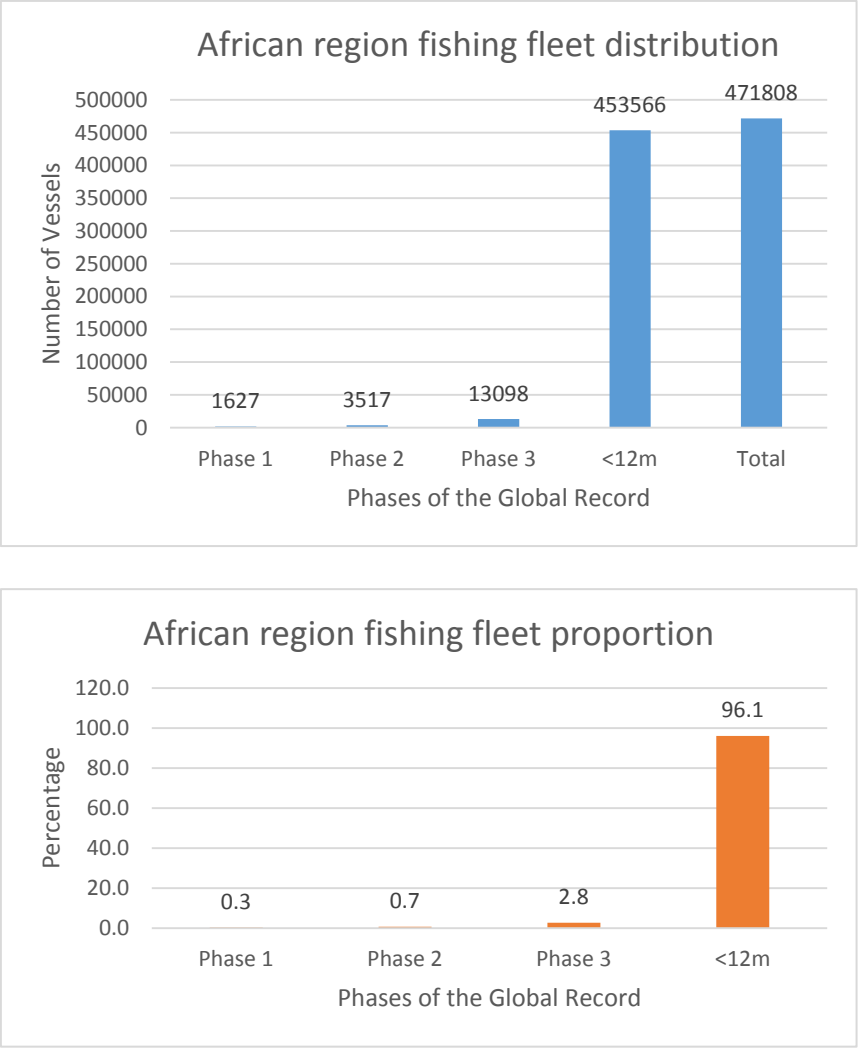

Figure 6: fleet distribution by phase in the African region

A quick glance on the length distribution obtained for Africa (Table 6[33]) immediately shows its practically total composition of small vessels engaged in artisanal fisheries and dependence to coastal resources. Vessels under 12 meters, depict the 96% of the total fleet (Figure 6). Fleet that can be resumed in three main groups, composed by a large portion of small-scale dugout canoes under 12m, other larger motorized canoes and coastal fleets included in phase 2 and large industrial vessels of national (phase 1) or distant water origin (mainly from Europe and Asia) operating under bilateral agreements or joint versions.

To conclude with this region, for the ultimate purpose of the Global Record of fighting IUU fishing, the third group of vessels defined, large industrial units that can potentially undermine the sustainability of the resources and coastal food security, should necessarily be included. Thus, for Africa the minimum valid length overall required, at least should be set at 24 meters.

7.2. Asian region

The Asian region owns the title of being the world's most productive region. Its high productivity is caused by the influenced of the Kurosho and Oyashio currents of the Northwest Pacific Ocean. Furthermore, other events as important river runoffs in the Gulf of Thailand and strong coastal currents and upwelling phenomenon in the Indonesian Sea enhance its total productivity even more (FAO, 2011b).

[33] Africa's vessel length distribution excluding: Namibia, Nigeria, Somalia, Sierra Leona, South Africa and Ghana. Data by segments of length not available for these countries.

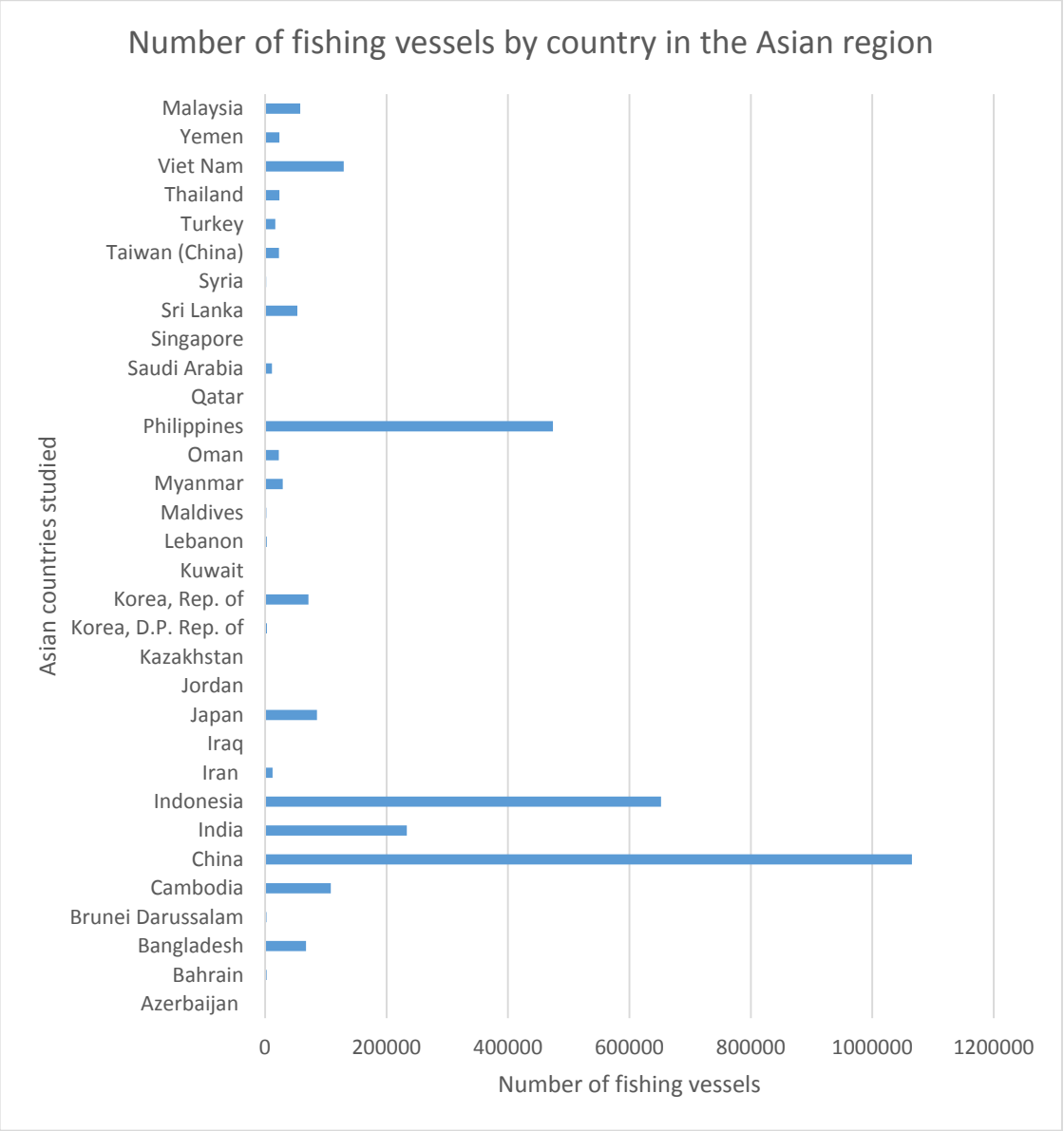

Figure 7: Asian fishing fleet

As consequence, Asia's fleet numbers reported reveal massive numbers of vessels that account for 3.176,136 units[34], from which around the 33% is represented by China, followed by Indonesia with almost the 21% and Philippines with the 15% (Figure 7). Those three countries constitute the biggest fleets of the world, accounting by their own the 47% of the global fleet. Other countries as Japan, Republic of Korea and Russia[35] not only have impressive fleets but also have a high rate of big tonnages, putting their fleets amongst the most important of the world.

[34] Georgia, Pakistan, Israel, Turkmenistan and United Arab Emirates not included. Data not available.
[35] No data available for the Russian Federation

Table 8: Asian fishing fleet by length segments

ASIA	<12m	Phase 3	Phase 2	Phase 1	Total1
Azerbaijan	861			14	875
Bahrain	2178	343			2521
Bangladesh	50892	10	28	166	51096
Brunei Darussalam	2295	12	22	4	2333
Cambodia	N/A	N/A	N/A	N/A	108145
China	N/A	N/A	N/A	N/A	1069910
India	N/A	N/A	N/A	N/A	233286
Indonesia	610655	34117	3241	3953	651966
Iran (Islamic Rep.of)	8760	2860	610	45	12275
Iraq	46	21	174	37	278
Japan	N/A	N/A	N/A	N/A	269736
Jordan	58				58
Kazakhstan			10	15	25
Korea, D.P. Rep. of	N/A	N/A	N/A	N/A	3036
Korea, Republic of	2095	4714	1365	1502	9676
Kuwait	697		151	13	861
Lebanon	2227	39			2745
Maldives	779	1329			2108
Myanmar	26354	1075	699	830	28958
Oman	19353	401	254	37	20045
Pakistan	18300	10020		7460	35780
Philippines	N/A	N/A	N/A	N/A	473998
Qatar	62	317	118		497
Saudi Arabia	10145	70	943	37	11195
Singapore	154	1	3		158
Sri Lanka	49610	1520			51130
Syrian Arab Republic	1732	59	8	7	1806
Taiwan (China)	6954	2789	2196	1739	13678
Turkey	18840				18840
Thailand	14425	7522	2990	865	23556
Viet Nam	N/A	N/A	N/A	N/A	129376
Yemen	22000	1301	4	8	23313
Malaysia	48076	6908	2988	0	57972

It is important to clarify that Asia's length distribution without the countries with the major fleets and vast proportions of vessels under 12m is roughly representative. Chinese length distribution, will significantly affect the phase proportions, as well as Philippines in a smaller rate. From the data available, amongst the countries with most standing out fleets for phase 1, Indonesia is highlighted as the most important, followed by Taiwan province of China and the Republic of Korea.

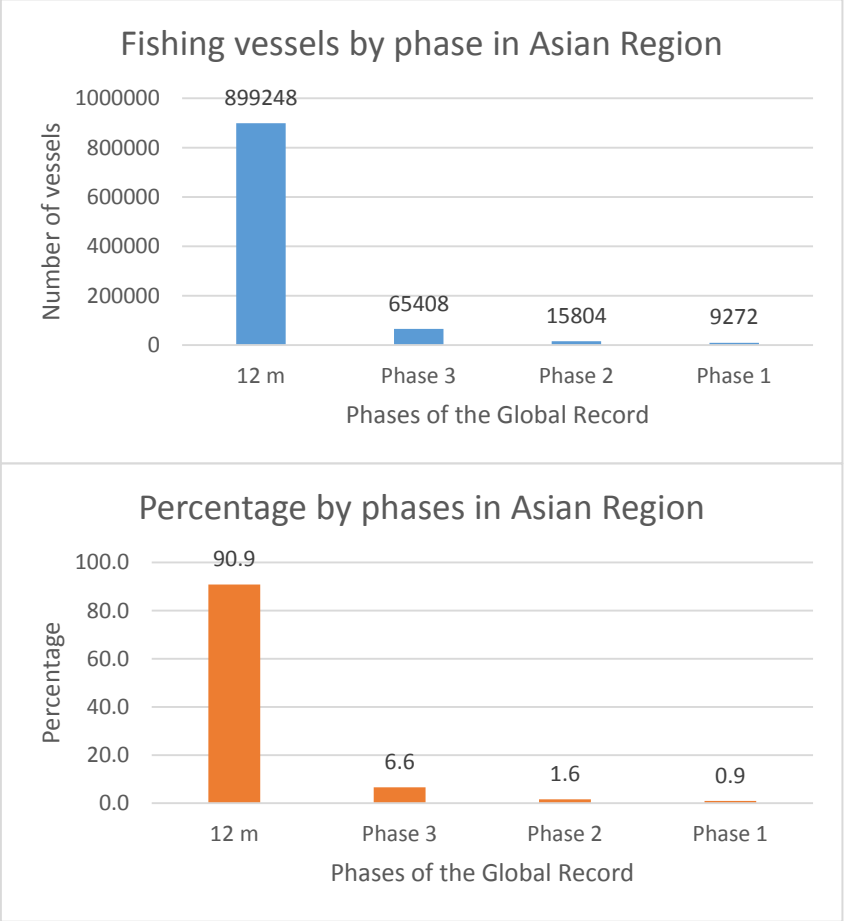

Figure 8: Number of fishing vessels by phase in the Asian Region

Acknowledging the importance of the Asian fleet on the total estimations and final conclusions, other records were consulted. For one of the most important regions of Asia, the regional organization of the Southeast Asian Fisheries Development Center (SEAFDEC) has developed a Regional Fishing Vessel Register (RFVR) built with official data belonging to the flag states listed on Table 8, plus Cambodia, Lao PDR, Philippines and Vietnam, for which there is no data available from the year 2008.

This data, unlike the FAO database is distributed instead in length classes, in tonnage classes making distinctions about NP (Non-powered vessels) and out-board powered vessels. The four phases displayed correspond only to in-board powered vessels as it wasn't possible to differentiate phases on the out-board powered vessel data presented.

Table 9: vessel fleet distribution by tonnage (source SEAFDEC)

			In-board P			
	NP	**Out-board P**	**PHASE 4**	**PHASE 3**	**PHASE 2**	**PHASE 1**
Malaysia	3032	37803	7241	6908	2988	0
Thailand			14425	6303	2352	476
Myanmar	13732	12490	132	1075	699	830
Indonesia	174184	237696	198775	34117	3241	3953
Brunei Darussalam			0	12	22	4
Singapore		146	5	7	0	0
Total	190948	288135	220578	48422	9302	5263
%	25.0	37.8	28.9	6.3	1.2	0.7

Due that NP and Out-board Powered vessels commonly refer to undecked vessels that are smaller to 24 meters of length overall. It can be derived, that the proportion for phase 1 of 0.7% is representative for the countries listed in Table 8 and not very distant from the stated from FAO database (0.9%). The non disaggregation in length classes of the fleets belonging to China, South Korea and Japan, may entailed a significant incertitude on final data results, preventing further conclusions.

7.3. European region

Characterized by its industrialized fleet, the European region owes its productivity to the North Atlantic current originating from the Caribbean. Other oceanographic events as the summer upwelling off the coasts of Spain and Portugal contributes to enhance productivity, as well as physical conditions like the extended shelf area off northern Europe (FAO, 2011b). Currently, European resources are recovering from their historical situation of overexploitation started in the late nineteenth century and early twentieth century, when innovation popped up the industrialization of the fishing fleet leading to a huge increase of fishing capacity.

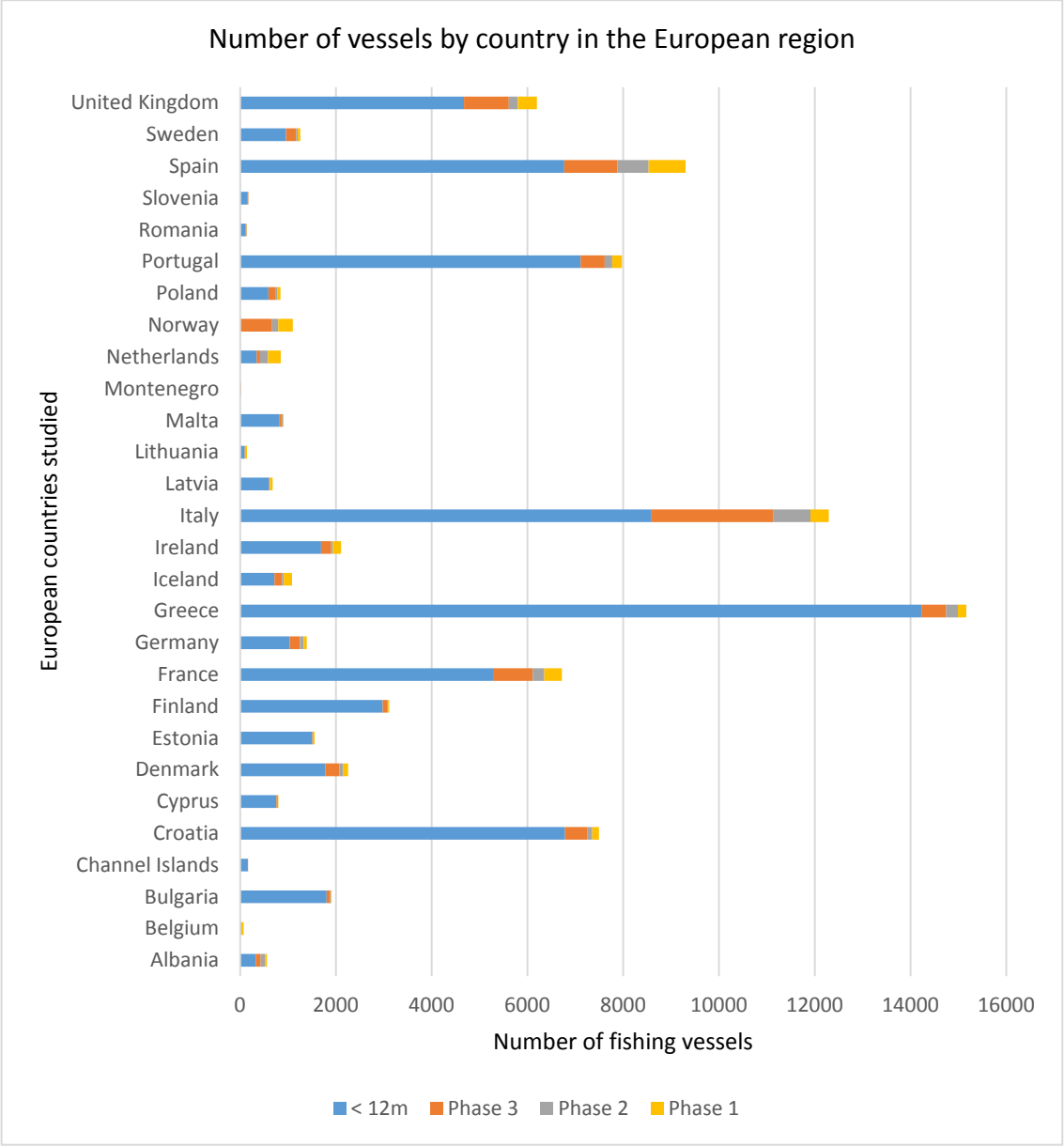

Figure 9: European fishing fleet by length segments

In this study, the fraction of the Global fleet represented by the European region including Albania, Norway and Iceland shows a total fleet represented by 93,567 vessels, from which 83,386 vessels are from the European Union. The biggest proportions of the fleet belong to Greece and Italy (Figure 9), two Mediterranean countries that mainly possess vessels under 24 meters of length overall, provided that the productivity of the area cannot support high rates of fishing effort even though (for the Italian fleet) the Gulf of Lions is one of the most productive zones of the Mediterranean.

Facing a situation of overexploitation on their own resources and pushed by the world's biggest demand of fishing products, the European fleet of the Atlantic side, grew in size to fish on distant fishing grounds. The implementation of the EEZs and RFMOs in international waters, entailed the European fleet into bilateral and multilateral agreements within which quotas or TACs were established and divided, decreasing the profitability of the fishing grounds. Nowadays, its vessel trend is decreasing in order to adapt its

capacity to the maximum sustainable yield of the fisheries in which the European nations participate.

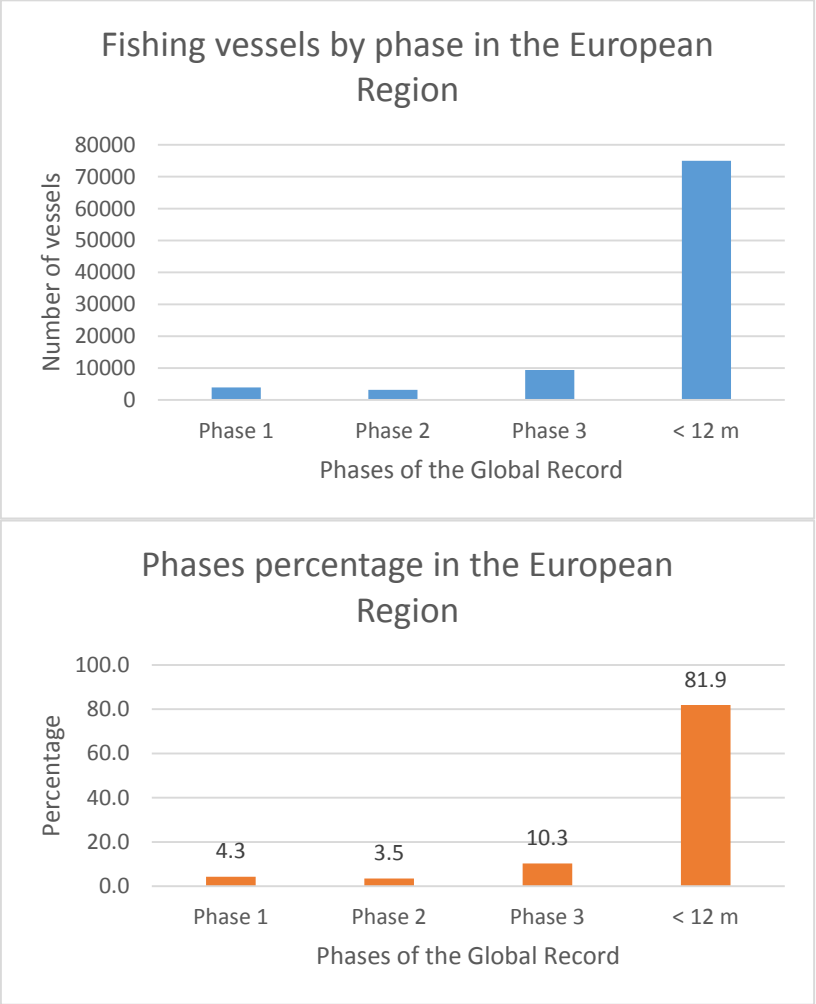

Figure 10: Global Record phases proportion in the European Region

Despite this loss of fishing profitability, vessels of phase 1 are still well represented by the 3,65% of the fleet, the highest global rate. The most relevant countries for phase 1 are Spain, United Kingdom, Italy (medium purse seiners just over 24 meters length), France, Norway, the Netherlands and Portugal. Is important to remark that in many of the distant fishing grounds where those countries were fishing, as consequence of the extension of the coastal States jurisdictional waters and development of developing countries fishing industries, many of the vessels belonging to phase 1, in order to continue with their activity formed subsidiary companies with locals reflagging the vessel in the country to have access to their resources under their national law and exigencies.

In summary, the European Region could be divided in two different fishing fleets that would be formed by the fishing vessels operating in the Atlantic Ocean side and those on the Mediterranean and Black Sea. While the Mediterranean and Black Sea fleet, to adjust the fishing capacity to the resources available remained characterized by medium and small size vessels, the Atlantic Ocean fleets became more and more industrial. Currently, the European region possess the most industrialized fleet in terms of total propor-

tions with presence all around the globe. Furthermore, the other phases are also well represented, due to the smaller proportion of vessels under 12 meters. Due to the international character of the European fleet it might be representative as example of the industrial fleets operating in the High Seas.

7.4. American region

America as a whole, represents a very vast region that concentrates the third part of the world's fleet with a total of 296.723 vessels reported. Its biggest fleets are represented in the North American[36] region by the United States of America with 75.695 vessels (Figure 7), then in Central America by México with 75.741 (Figure 8) and in South America by Ecuador with 29.977 vessels (Figure 9).

Regarding North America, the region encompasses two different oceans and conditions. In the Northwest Atlantic coast, this region possess an extensive continental shelf that extends into international waters and a slope out to 1000 meters deep. Fishing grounds in this area are productive and enriched by biological processes that feed on the interactions with artic and subpolar currents (Labrador Current) and the warm tropical Gulf Stream. In the Northeast Pacific, productivity is influenced by three physical and environmental phenomenon, the California Coast Currents, Gulf of Alaska Gyre and eastern Bering Sea shallow shelf system (FAO, 2011b). These high productivity conditions have historically had a great impact on North American countries as Canada that developed a strong dependence to cod catches and the United States, that built the largest fleet of the entire continent. Unfortunately, no data by length distribution could be got from any North American fleets, impeding to elaborate further conclusions.

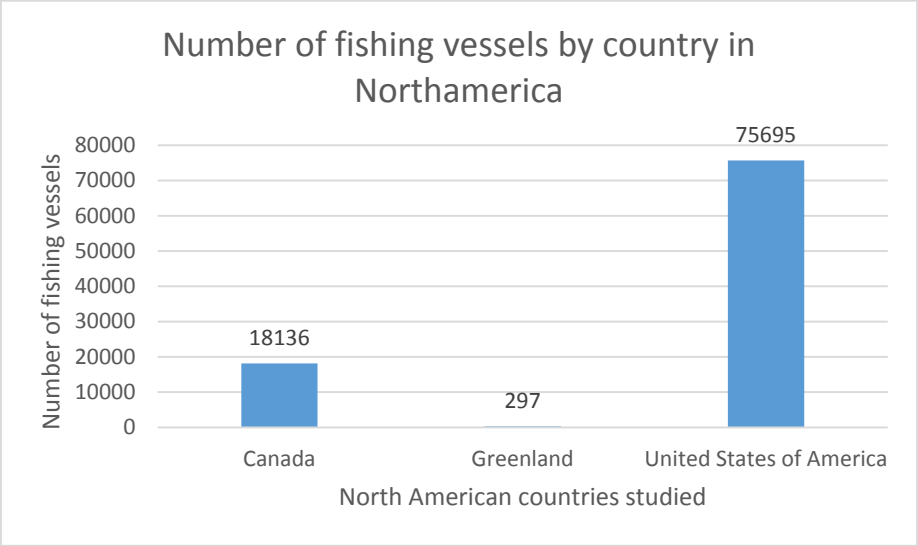

Figure 11: North American fishing fleet

The Central American region, on the Western Central Atlantic possess high productivity areas influenced by the contribution of big river runoffs as the Orinoco, Mississippi and Amazon

[36] Within North America is included Greenland, as in the FAO database consulted.

rivers. In the Eastern Central Pacific albeit, coastal upwellings are the most important source of coastal water nutrients. Thus, the fleet from the Caribbean region is characterized for being a small size fleet targeting local resources represented mainly by shrimp, lobster, sparids, tuna and tuna-like species as sharks.

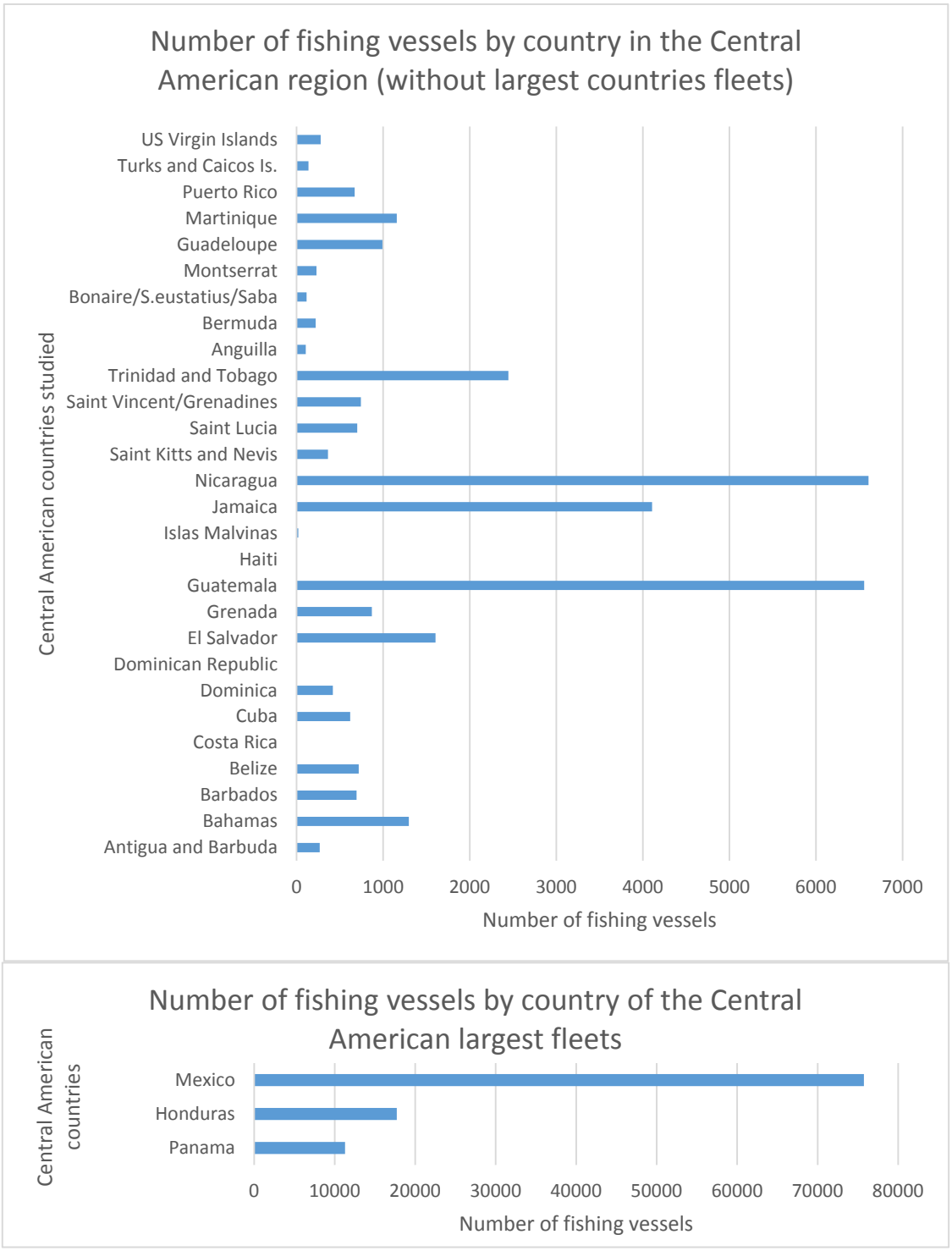

Figure 12: Central American fishing fleet

Nevertheless, since the creation of the first flag of convenience in Panama in the 1920s (nowadays called open registers), several countries as Belize and Honduras, as well as multiple

overseas Caribbean dependencies, have followed the idea. As consequence central American countries and overseas dependencies currently possess distant water fleets with industrial vessels hosted. Despite foreign contributions to Central America's fleet, vessels over 24 meters of length overall represents the 0.4% of the fleet, strongly remarking the artisanal character of this fleet.

Apart from the lack of length segments of the fleet for the North American countries, the gaps found in the entire American region are attributed mainly to Central America. Missing of country data in a region where some of the most relevant open registries are settled, might probably constitute the major problem for fleet transparency of the continent. Despite this, some of the countries and overseas dependencies hosting flags of convenience like Panama or Saint kitts and Nevis had reported their fleet data as can be seen in Figure 12 or Table 9.

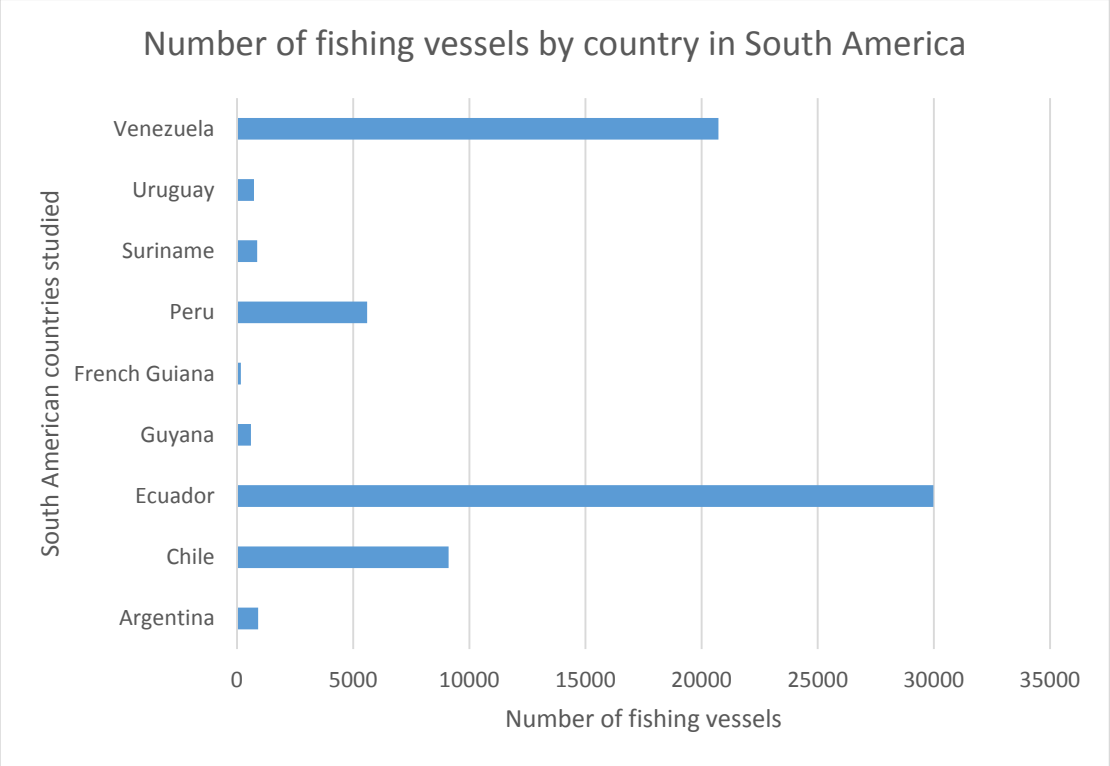

Figure 13: South American fishing fleet

Examining closer the case of Saint Kitts and Nevis, in table 9 can be observed that its fleet is composed by 362 vessels, all of which are < 12m, except 5 vessels included on phase 3. Due that in some particular cases, no connections between different national departments result on concealing the industrial fleet out from the fishery department into other departments, registers should be observed carefully.

Table 10: Central American fishing fleet by length segments

CENTRAL AMERICA	<12m	Phase 3	Phase 2	Phase 1	Total
Antigua and Barbuda	100	4			
Bahamas	1063	148	64	21	1296
Barbados	586	103	3		692
Belize	717				
Cuba	146	398	65	10	619
Dominica	410	9			419
El Salvador	13604	46	113	5	13768
Grenada	752	64			869
Guatemala	6500	27	25	4	6557
Honduras	17486	80	95	48	17712
Islas Malvinas				20	20
Jamaica	4081	24	2		4107
Mexico	68648	617	1931	458	71654
Nicaragua	6482	4	84	36	6606
Panama	10890		388	4	11282
Saint Kitts and Nevis	357	5			362
Saint Lucia	693	6	1		700
Saint Vincent/ Grenadines	731	8		3	742
Anguilla	102	4			
Bermuda	190	30			220
Bon-aire/S.eustatius/Saba	116				116
Guadeloupe	990		1		991
Martinique	1149	3	5		1157
Puerto Rico	669	1			670
Turks and Caicos Is.	138				138
US Virgin Islands	274	4			278
	136874	1585	2777	609	140975

In the case of South America, we found two highly productive areas that contributed to develop the fishing fleets of the coastal countries affected. In the Atlantic side, the resources abundance is highly influence by the two South American rivers, the Amazon River and the Plate River, that combined with the largest continental shelf of the southern hemisphere derive high productivity rates. Furthermore, in the pacific side, seasonally, the Humboldt-Peru eastern boundary current system generates the cold nutrient rich coastal upwelling that makes this region one of the most productive areas of the world. As consequence, its fleet benefits from the extraordinary productive conditions of the region.

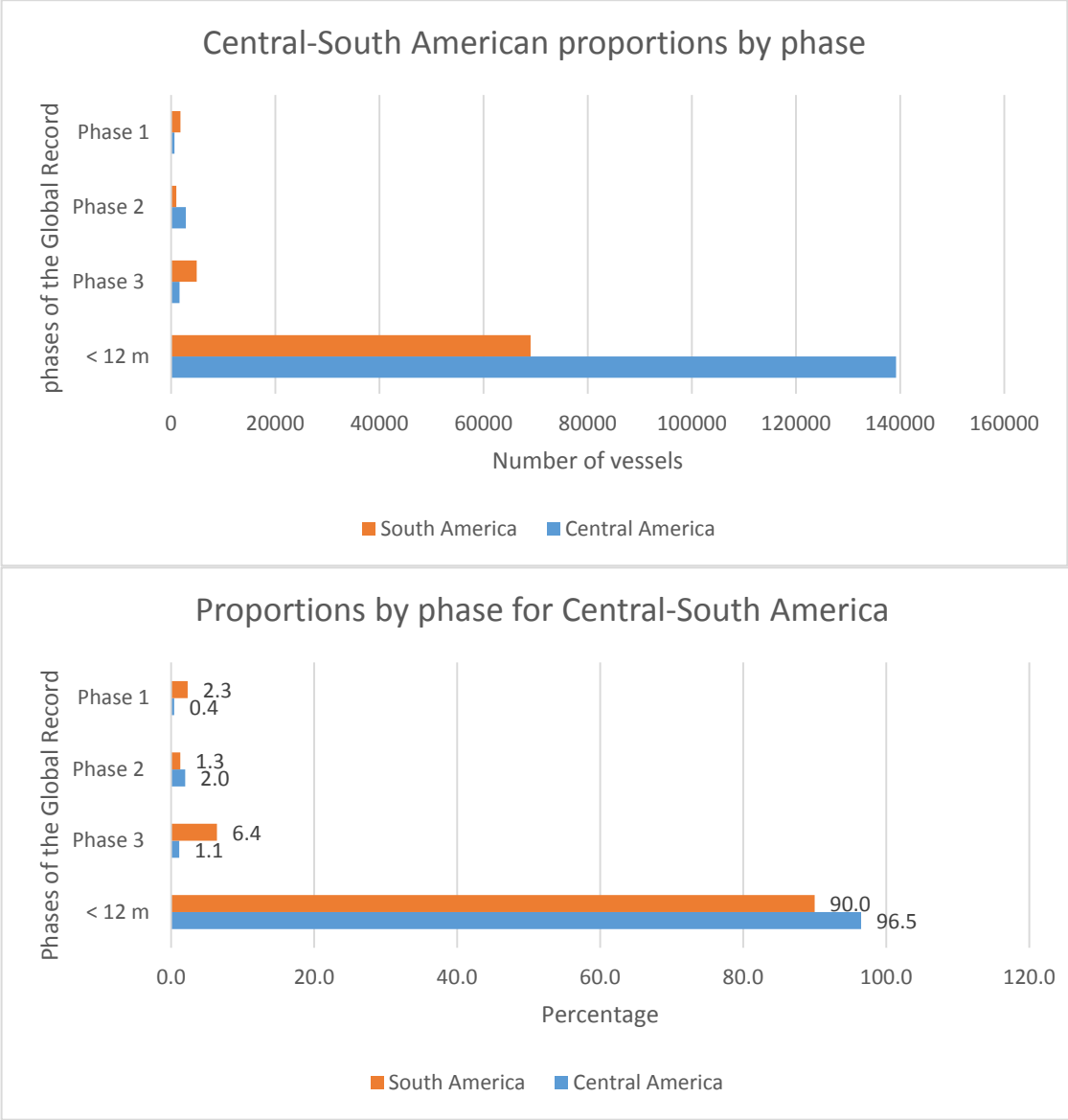

Figure 14: Central - South America's fishing fleet by phases of the Global Record

Large continental shelves in the Argentinian side feed by cold currents from the Antarctica support industrial fleets in Argentina and Falkland Islands. And similarly, the ecological proceses produced by the upwellings in the Peruvian side, create one of the most special and productive conditions that contributes to develop big industrial fleets in Peru, Chile and Ecuador. This is reflected on the Phase 1 proportion for South America that goes up to 2.3 % and is significantly higher than in other regions of America (Figure 14)[37]. As result of the last, Peruvian anchovy remained by far the most caught fish in the world.

[37] Missing North American information for comparison. No data available of North American fleet length or tonnage distribution.

Table 11: South American fishing fleet by length segments

SOUTHAMERICA	<12m	Phase 3	Phase 2	Phase 1	Total1
Argentina		140	74	350	
Chile	11283	494	144	254	12175
Ecuador	35410	181	135	68	35794
Guyana	321	162	115		598
French Guiana	134	4	26	1	165
Peru	3401	792	248	914	5355
Suriname	385	397	65	17	864
Uruguay	662		27	41	730
Venezuela, Bolivarian Republic of	17432	2746	154	130	20787
	69028	**4916**	**988**	**1775**	**76468**

7.5. Region of Oceania

Oceania, characterized for its archipelagos and volcanic origin, is constituted of islands as the size of Australia and archipelagos of tiny islands where continental platforms are mainly too narrow to support extensive continental shelf demersal fisheries, with exception of northern Australia and New Zealand continental shelf. Productivity is concentrated in areas where there is upwelling of nutrients, often associated with seamounts and ridges that offer shallower places accessible for bottom fish as the Lord Howe Rise, the South Tasman Rise and the Louisville Ridge. Pelagic fisheries are also associated with places where upwelling occurs and are mainly constituted by jack mackerel and squid. Due to its tropical conditions, other oceanic fisheries, based on the large tuna resources associated to this region conform the most important fishery.

As aforementioned, this region is barely represented by the data available. Nevertheless, a generic analysis of the FAO data indicates the presence of countries with small fleets that are characterized by a heterogeneous distribution of their phases comparing one to the other. This can be observed contrasting the high size rate associated to Papua New Guinea, followed by Guam and New Zealand, in contrast with the large amount of vessels under 12 meters reported by Fiji or the French Polynesia.

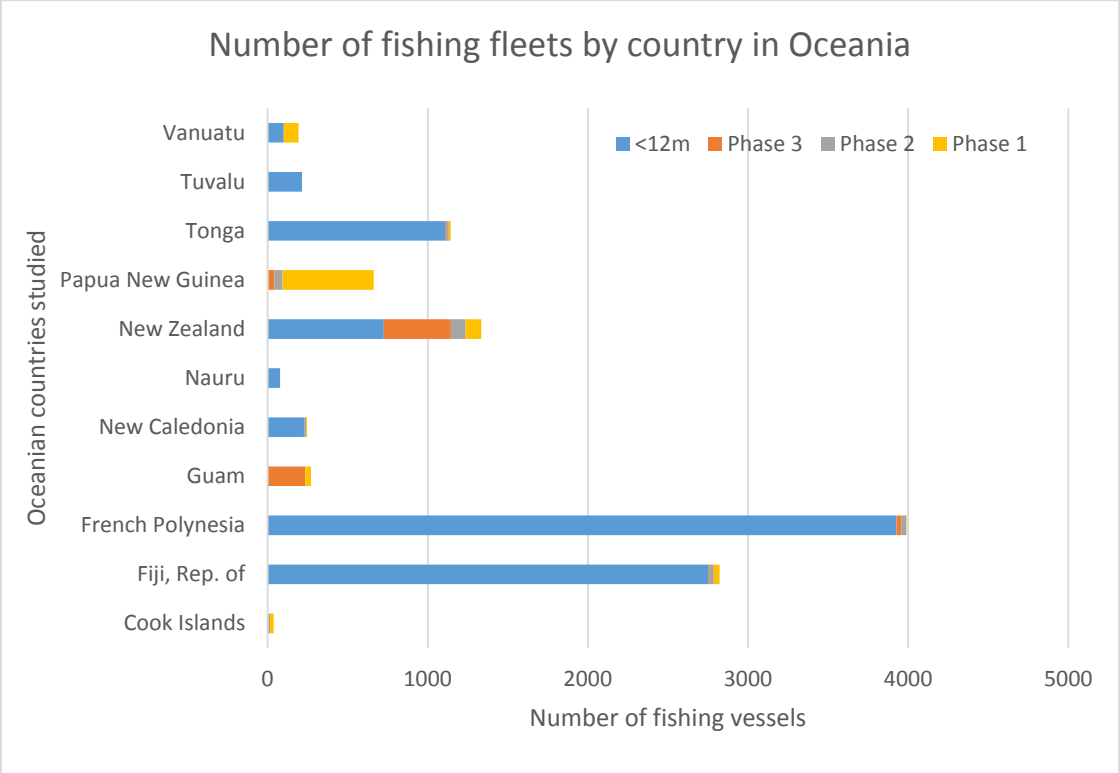

Figure 15: Oceanian fishing fleet by length segments

These differences are the contrast between more developed industrial fleets used by countries with higher fishing investment and traditional fleets associated to domestic and inshore fisheries more characteristic of small islands and archipelagos where economical investment is limited. Albeit, the presence of vessels over 24 meters length could reveal a future trend to a more industrialized fleet that could take more advantage of high migratory species resources.

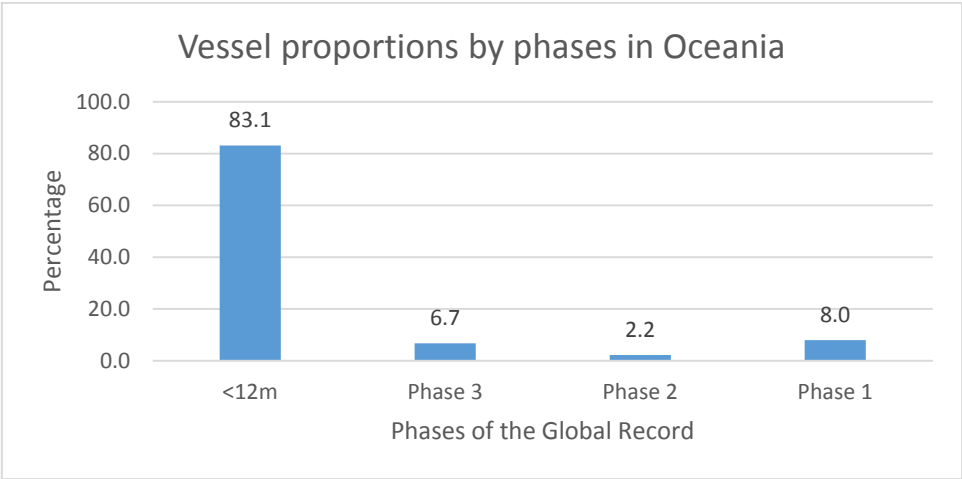

Figure 16: Oceanian fishing fleet proportion by phases

The fleet is not very large, although tuna fisheries employed large vessels to fish over 24 meters length overall, as it can be deducted from Figure 16. However, from Figure 15, the extensive proportion of phases 1 seems to be in a great part due to Papua New

Guinea. In order to address the law representativeness of the data available for this regions and surpass deficiencies, other sources coming from RFOs such as Pacific Islands Forum Fishery Agency (FFA), were analyzed.

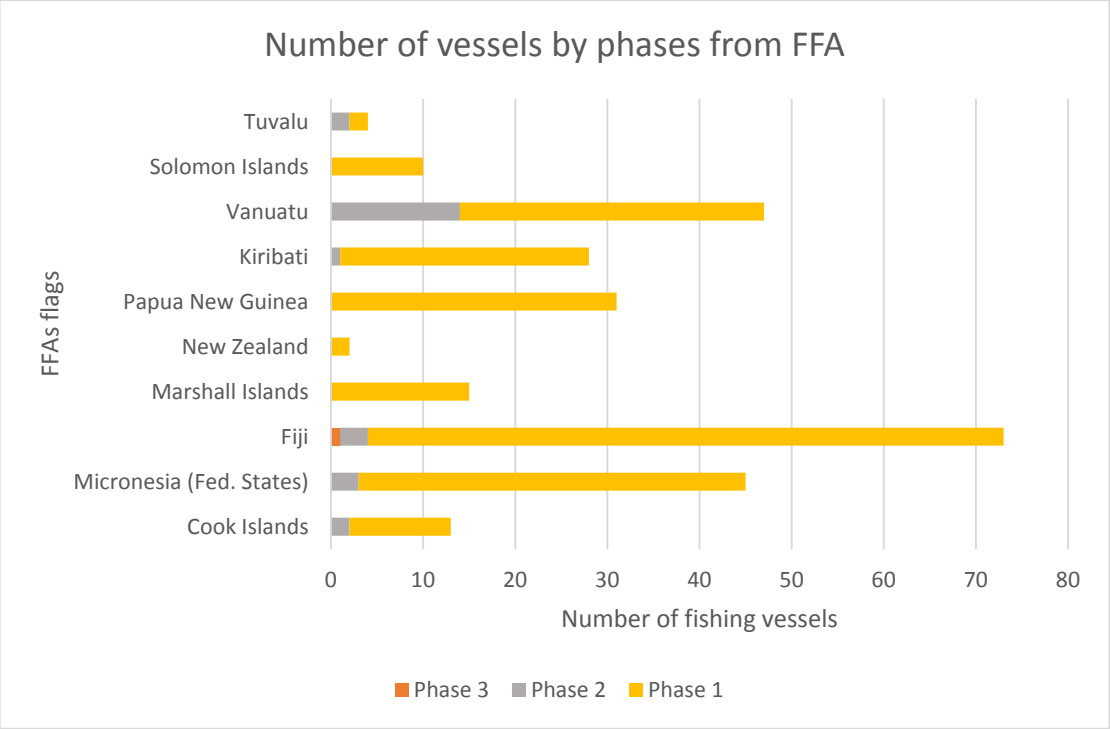

Figure 17: Oceanian fishing fleet from FFA all good standing list

The data used for analysis coming from FFA databases for this case, correspond with the good standing list offered by FFA, that includes vessel characteristics. In this list, vessels from all the flags displayed in Figure 17, are licensed by their Flag State to catch tuna fisheries. Thus, as can be observed, tuna fleet is constituted by large fishing vessels. Depending on the main fisheries undertaken by the different islands, those targeting tuna, will possess a high proportion of vessels of phase 1.

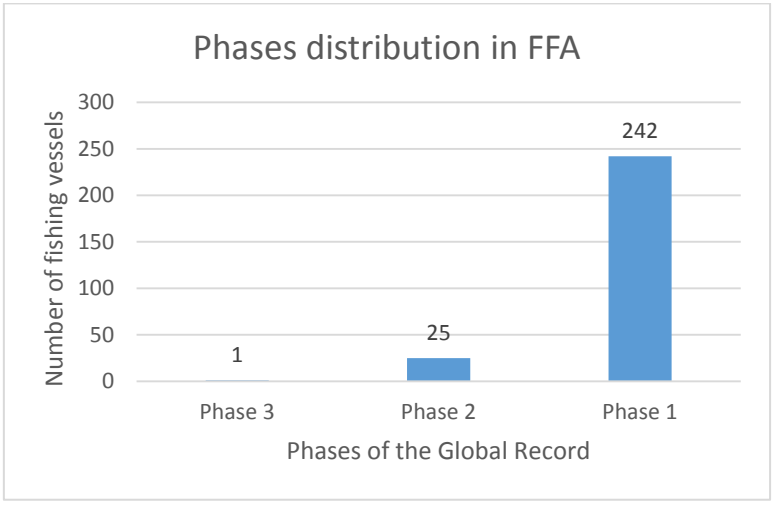

Figure 18: Oceanian fishing fleet proportions from FFA

Other databases, as the South Pacific Regional Fisheries Management Organization (SPRFMO) Record of Vessels managing non-tuna resources in the High Seas of the Southern Pacific were also analyzed. Results observed for those Oceanian vessels fishing on seamounts and ridges, indicate that just two Vanuatu trawlers are involve on international waters bottom fishing.

8. Automatic Information System (AIS) data analysis

The data provided by Global Fishing Watch pretended to bring a glimmer of enlightenment to those parts of the globe covered by the shadow of unawareness. Every vessel equipped with AIS broadcast data that is registered by low orbit satellites during their fishing activities and the information is derived on maps that can relate the fishing activities with global coverage.

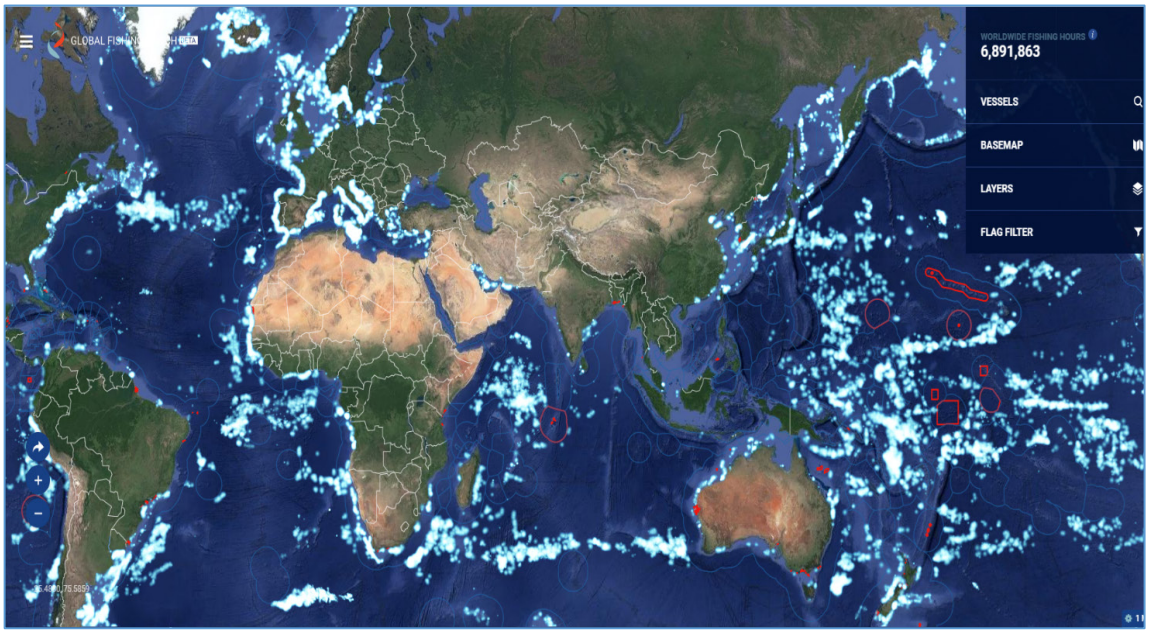

Figure 19: GFW world map on fishing vessel activity

The results found nevertheless, although of great value for management and encouraging for control activities, revealed some weaknesses. The vision of the fleet is partial, due to its initial reason of conception to assist vessel trafficking providing security alerts and previsions for avoiding collisions, AIS was only intended for big vessels performing international voyages. Thus, 49% of the vessels possessing AIS tracking systems correspond to phase 1, leaving the rest of the phases with little coverage (Figure 20).

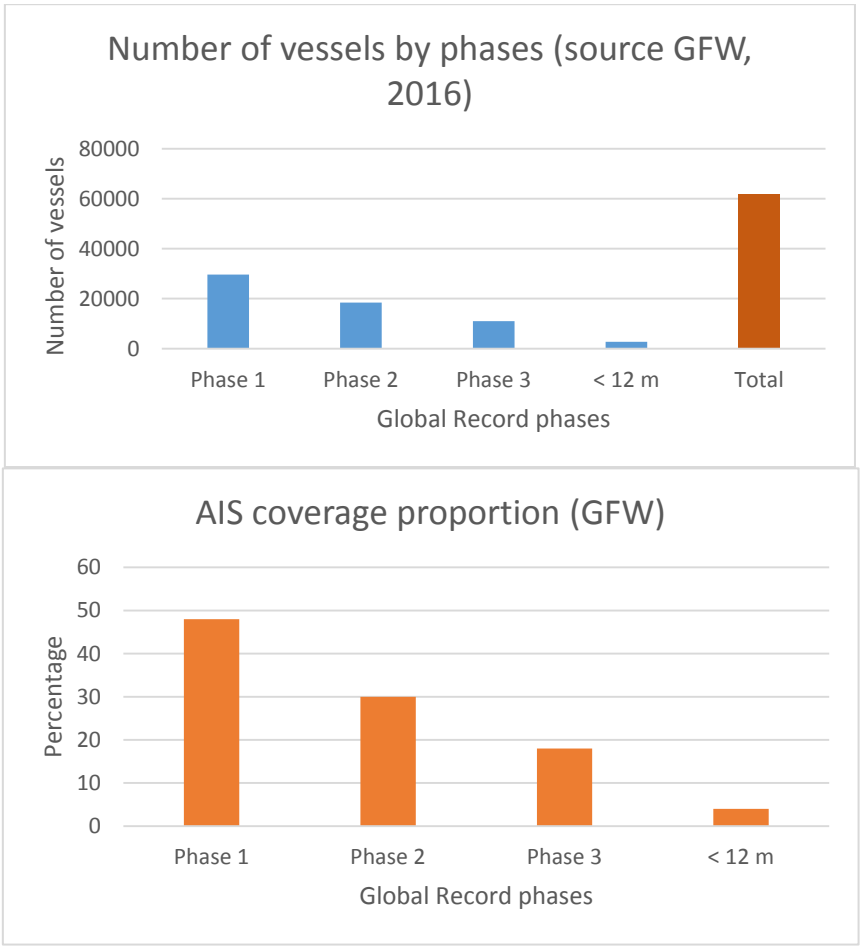

Figure 20: enforcement of AIS in global's fishing fleet

Knowing that AIS mainly applies for big vessels from phases 1 and 2 involved in High Seas fishing operations (Figure 20), allows to established by the recognition of their flags who are the countries with distant waters fleets and to ponderate them (Table 11).

Thus, examining AIS tracking positions, while taking into account the fraction of vessels over 24 meters with AIS (Figure 21), can be concluded that China and Taiwan (province of China), followed by Japan, Spain, South Korea, United States, etc., might be the top ranking fleets fishing in High Seas and neighboring EEZs.

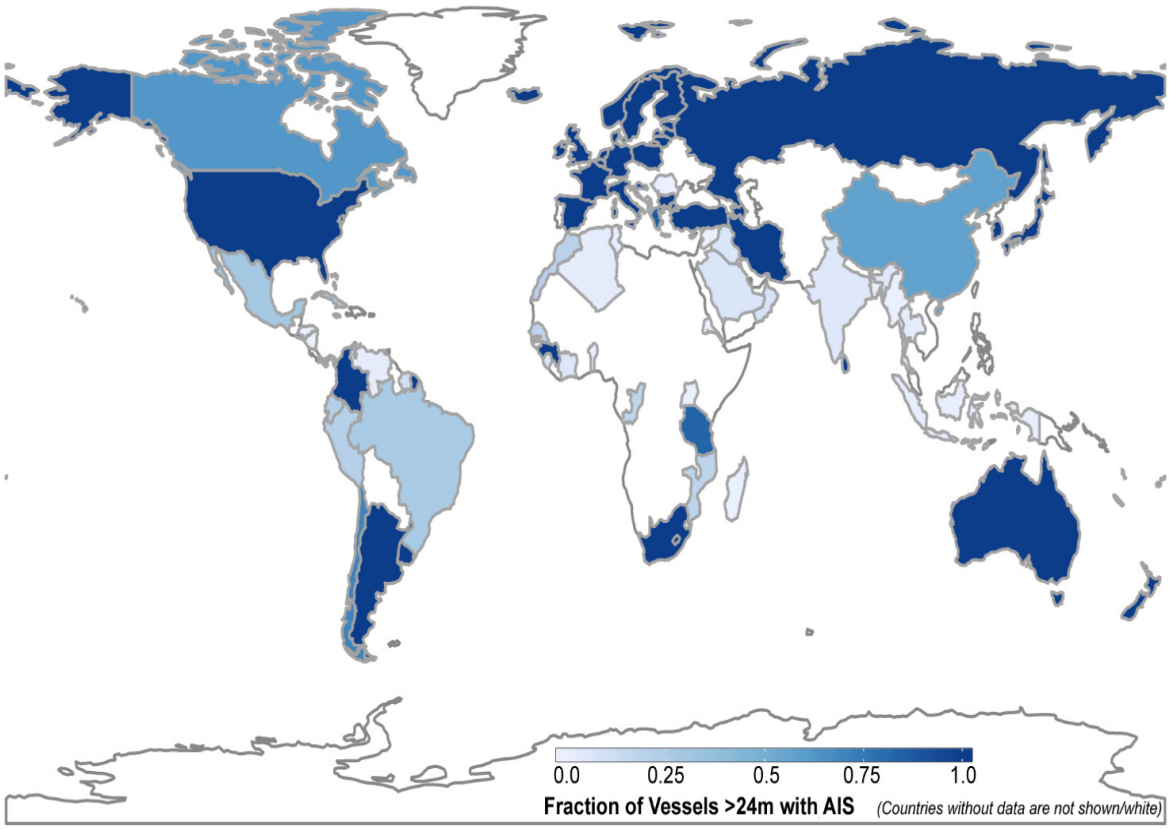

Figure 21: GFW map with fraction of Vessels>24 m with AIS

Another weakness of the AIS tracking systems currently, if its lack of global enforcement accounting in 2016 with 61800 vessels. Since IMO established in 2002, the obligation for certain vessels to install Automatic Information Systems, fishing vessel's inclusion was let to discretion of flag State administrations. Even some administrations, like the European extended AIS requirement to vessels of 15 meters and above of overall length, many others did not compromise. Currently, the ratio between enforcement and coverage of the AIS, mainly comprehend Europe, United States, Argentina, Russia, Japan, South Africa and New Zealand. Leaving have of the China fleet over 24 meters of overall length uncovered and mostly all the southeast of Asia, with the world's biggest fleets in the shadows (Figure 21).

Table 12: Number of vessels with > 48h of fishing in High Seas by country

Country	Number of vessels with > 48 hours

	of fishing in High Seas in 2016
China	827
Taiwan	528
Japan	452
Spain	245
South Korea	205
United States	129
Invalid MMSI (mostly Chinese)	106
Russia	80
Portugal	61
Vanuatu	54
Norway	42
Seychelles	26
Mexico	25
Fiji	25
Canada	20
Faroe Islands	19
France	15
Federated States of Micronesia	13
Ecuador	13
Colombia	11

9. Vessel type analysis

The analysis of the different databases mentioned under the Material's chapter, disclose that low harmonization between databases is followed in terms of vessel type and gear type for further study. As a consequence, information systems as the Fishing Vessel Finder that compiles vessel information from different sources on the internet, collects and displays up to 323 different vessel types. To avoid it, the Global Record uses and recommends the use of the International Standard Statistical Classification of Fishery Vessels by Vessel Types (ISSCFV) that was agreed internationally as vessels type's standardized list for harmonization of vessel registers and records.

Vessels under general type not harmonize as "Multipurpose" causes problems on distinguishing and grouping gear types under its respective international type. Then, in those situations in which vessels might be authorized to fish with several gears during the same year period, some databases include them on a multipurpose category if this is considered in the vessel's national register. However, in some Regional Fishing Vessel Registers (as SEAFDEC) this is counted as different records, one for each gear, deriving on errors from the real situation.

Table 13: Vessel type distribution in FAO database

Gears	Number of vessels	Percentage
Trawler	149466	6
Seiner	118813	5
Long liners	39020	2
Gill netters	142727	6
Trap setters	22495	1
Multipurpose	227059	9
Dredgers	624	0
Fishing Vessels	1877487	73

For a global analysis, general numbers of vessel types (Table 12), shows that there is a great incertitude. About the 73% of the vessels provided do not have the gear defined and for this, no valuable conclusions can be extracted from the FAO database at this level. Nevertheless, the results from AIS data provided by Global Fishing Watch (Table 13), that mainly affects vessels of phase 1, depicts that trawlers are the most common vessel type, followed by fixed gears for medium size vessels like gillnetters, seiners and longliners.

Table 14: Vessel type distribution facilitated by Global Fishing Watch

	GLOBAL FISHING WATCH						
	All gears	Trawlers	Seiners	Squid jiggers	fixed gear	other	LL
Phase 1	29648	18246	3122	536	3843	988	2913
Phase 2	18444	10305	1738	0	4631	473	1297
Phase 3	10996	5025	817	0	4299	507	348
< 12 m	2712	479	50	0	2065	106	12
Total	**61800**	**34055**	**5727**	**536**	**14838**	**2074**	**4570**
%		55.1052	9.26699	0.867313916	24.0097087	3.356	7.395

A regional approach however shows a different pattern depending on the commercial species targeted and regulated by the different RFMOs. RFMOs mainly regulate fishing activities in the High Seas and then can serve to characterize the type of fleets that use to fish in distant waters according to the objective species. The main commercial fishing grounds in the High Seas, are represented by high migratory species fisheries as tuna and tuna-like species, bottom fisheries for demersal species as cod, haddock, green halibut, toothfish or crustaceans and midwater and pelagic fisheries for mackerel, herring, horse-mackerel or squid.

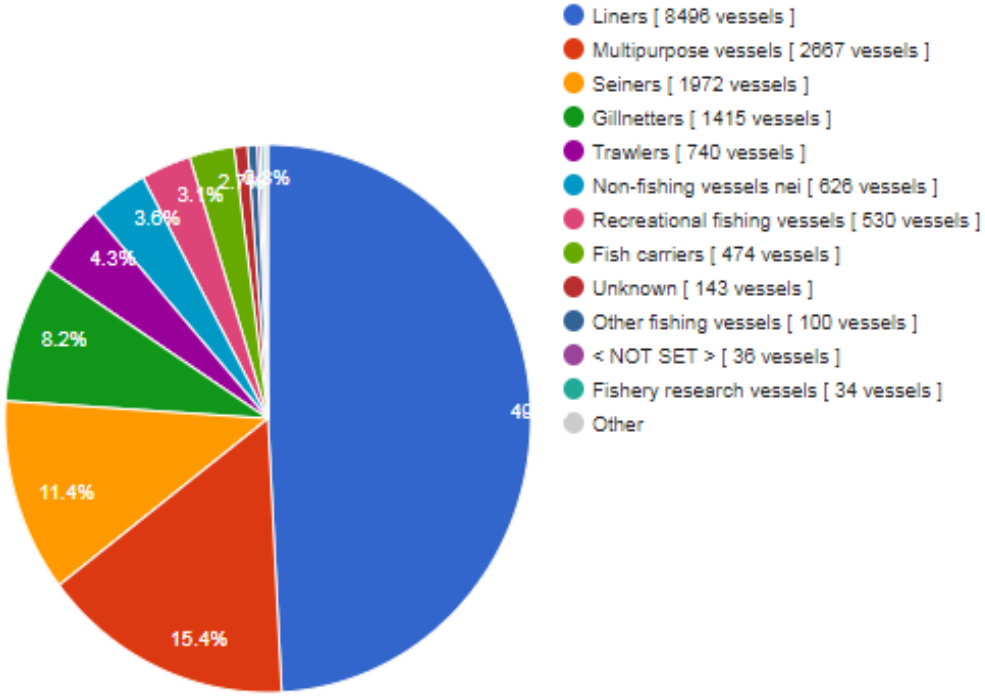

Figure 22: Vessel type distribution in CLAV database

Tuna-RFMOs will then point out which are the gears and vessels use for catching tuna and tuna-like species. In terms of vessel numbers, between the most common tuna vessel types are liners, multipurpose vessels (using hooks and lines mostly) and different types of purse seiners (Chart 1). In a smaller proportion gillnetters and pelagic trawlers are also use for these species, even in 1991, the United Nations banned the use of large scale high seas driftnets over 2.5 kilometers long and many Regional Bodies adopted this moratoria. Bottom fisheries, like those regulated by NAFO, CCAMLR, SIOFA, SEAFO[38], etc., usually are dominated by large trawlers, bottom longliners and in the case of crabs, traps (Table 14). At last, midwater and pelagic fisheries in the High Seas, are dominated by purse seiners and trawlers.

Table 15: Vessel type distribution at regional level

TYPE OF VES-	SIOFA	%	SEAFO	%	CCAMLR	%	SEAFDEC	%	FFA	%

[38] The study of the Authorized Vessels List provided by SEAFO, reveals that there exists many errors and irregularities on it related with the dimensional characteristics and IMO numbers associated to the vessels. Those errors where contrasted by reliable data bases as GISIS, and corrected.

SELS										
SEINERS	5	21	6	33			123503	9	268	27
TRAWLERS	1	4	1	6	35	31	31801	2		
LONGLINERS	1	4	5 (LL,POT)	28	45	40	516244	38	739	73
GILLNETS							420216	31		
TRAPS	16	67	5	28			177886	13		
DREDGES							25695	2		
MULTIPURPOSE			1	6	32	29				
OTHERS							62428	5		
Grand Total	**24**	**100**	**18**	**100**	**112**	**100**	**1357773**	**100**	**1007**	**100**

In those cases where RFMOs regulate also jurisdictional waters of the countries involve, the picture as also occurs examining the European Fishing Fleet Register (Table 15) diversifies. Instead of being centered on trawlers, purse seiners, longliners and traps, other types of vessels as gillnetters, hooks and liners (included in longliner type for SEAFDEC column of table 14), other seiners and dredges.

Table 16: Vessel type distribution EU Fishing Fleet Register

Phases	Dredge	Traps	Seiner	Gillnets	Liners	Trawler
1	204	40	463	121	355	2213
2	79	42	544	164	154	1908
3	1059	543	841	1892	910	3155
4	962	8397	2885	41238	13874	1624
Total	2304	9022	4733	43415	15293	8900
%	2.76	10.8	5.676	52.065	18.34	10.673

However, at national level, even the proportions change and the spectrum of types is larger, dropping the percentage of vessel types as trawlers to 10% (Table 15) or even 2% (SEAFDEC Table 14). The contribution of each of the types in terms of production strongly remark the importance of the trawlers and seiners (Chart 2), and their possible impact on fisheries management.

In summary, in terms of numbers longliners, trawlers and seiners are the most common fishing vessels on High Seas and distant water fisheries. When the approach becomes national other types as gillnetters, different seiners, hooks and lines vessels and dredges appear. In terms of production, trawlers and seiners show the biggest contribution of all the types and respectively the bigger sizes.

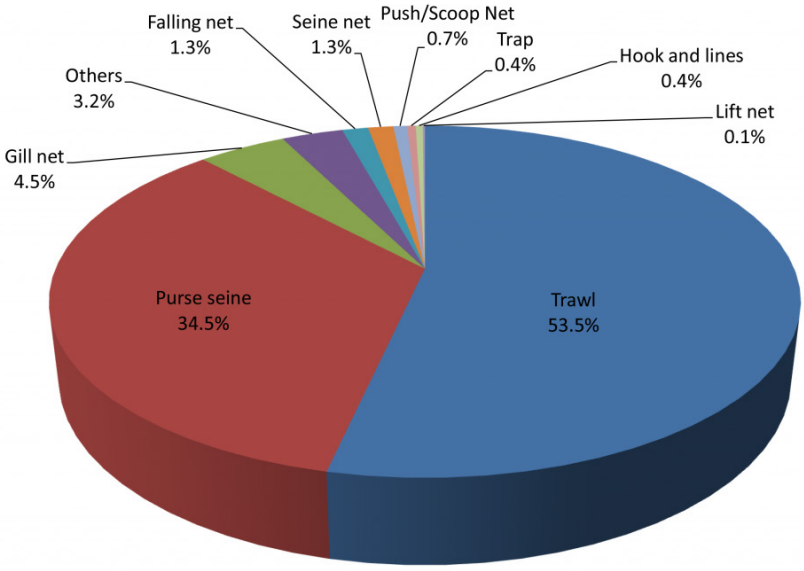

Figure 23: SEAFDEC Marine capture fishery production in 2014 by type of gear used

10. Global fishing fleet on the High Seas and EEZs outside national jurisdiction

The importance and definition of IUU fishing activities is sharply link with the compliance of fishing vessels in the High Seas. Hence, in determining the minimum length overall that should be consider as inferior boundary for the submission of fishing vessels into the Global Record information system, fishing vessels operating on the High Seas.

A prior analysis of the questionnaires in relation with the fleet that operate on the High Seas, permits to extract some cautious preliminary conclusions on their usual composition. From Table 16[39], can be clearly established the high level of engagement of Phase 1 beyond national and neighboring EEZs depending on the region and countries. Phase 3 and vessels below 12 meters of overall length where not considered due to its nearly non existent representativeness.

[39] Countries that didn't present any vessel in any of the categories as Bosnia and Herzegovina, Somalia, Sudan, Djibouti and Singapore weren't included. The Netherlands data due to the report of the same figures in each phase was not considered.

Table 17: Relation on the number of vessels per phase that operates on High Seas

	High Seas Phase 1	Fleet Phase 1	%	High Seas Phase 2	Fleet Phase 2	%
ARGENTINA	130	350	37.1	1	74	1.4
THAILAND	16	865	1.8	-	2990	-
NORWAY	123	305	40.3	0	130	0
SINGAPORE	1 Reefer	1 Reefer	100	0	3	0
MAURITANIA	242	242	100	0	102	0
VANUATU	57	90	63.3	39	-	-
NEW ZEALAND	13	99	13.1	2	91	2.2
EUROPEAN UNION	1983	3428	57.8	1972	3928	50.2
GREECE	6	178	3.3	1	242	0.4
FRANCE	350	371	94	164	238	69
TRINIDAD & TOBAGO	10	17	59	18	51	35
SLOVENIA	0	0	0	0	0	0
ANGOLA	57	158	36	0	61	0
ICELAND	-	-	-	-	-	-

An extensive region as the European Union involving twenty-three coastal countries, indicates that mainly more than the half of their Phase 1 vessels fish on international waters. For the case of the European Union may be necessary to remind that countries operating in the Mediterranean Sea have not already extended their jurisdictions to 200 nautical miles due to Mediterranean Sea's characteristics. In this sense, just from the data reported to the HSVAR, Italy and Greece on 2013, reported a total of 597 vessels authorized to fish on High Seas. Due to the artisanal composition of those fleets on the Mediterranean with lengths around 24 meters for the bigger vessels, phase 2 in the case of the European Union entails a high rate of vessels operating in the High Seas. To clarify this matter, more data per country would be needed as France and Greece present contradictory situations.

Table 18: Relation on the number of vessels per phase that operates on different RFMOs

	CCAMLR	%	NAFO[40]	%	SIOFA	%	SEAFO	%	SPRFMO[41]	%
Phase 1	112	100	224	100	23	95.8	18	100	64	100
Phase 2	0	0	0	0	1	4.2	0	0	0	0
Phase 3	0	0	0	0	0	0.0	0	0	0	0
< 12 m	0	0	0	0	0	0.0	0	0	0	0
(blank)	0	0	0	0	0	0.0	0	0	0	0
TOTAL	112	100	224	100	24	100.0	18	100	64	100

Phase 2, apart from the particular cases of the European Union and Trinidad & Tobago, do not have a strong presence in High Seas in all remaining cases. This situation strongly emerges when the fishing grounds analyzed are covered by RFMOs whose Convention Areas lie beyond the areas in which Costal States exercise fisheries jurisdiction, outside of the Exclusive Economic Zones (Table 17), or High Seas.

Table 19: Relation on the number of vessels per phase that operates on different RFMOs

	CLAV	%	FFA	%
Phase 1	6487	37.6	882	88
Phase 2	4556	26.4	96	10
Phase 3	3255	18.8	26	3
< 12 m	1829	10.6	0	0
(blank)	1141	6.6	3	0
TOTAL	17268	100	1007	100

Those Regional Bodies that regulate mainly straddling stocks for a proper management of the species under the Convention, establish Convention Areas that include usually the EEZs of the different parties. Thus, smaller vessels are involved as authorized vessels and the distribution between phases is not so polarized to phase 1 as can be observed in Table 18. Those Regional Bodies even they area of regulation includes High Seas, cannot be representative of the situation in the High Seas.

The same preliminary assessment conducted about the fleet operating on neighboring EEZs, reveal similar general trends; Phase 1 incur in fishing on other neighboring EEZs in bigger proportions that the rest of the fleet segments. Nevertheless, coastal and country's boundaries proximity facilitate the access of smaller vessels of phase 2 to the neighboring country's resources resulting on bigger numbers on the table below. Despite the easier access, from the table mentioned can be concluded that only a little fraction of

[40] Data extracted from FAO website: http://www.fao.org/fishery/topic/18075/en

[41] For more information, website of SPRFMO: https://www.sprfmo.int/data/record-of-vessels/

fishing vessels under phase 1 fish on Neighboring EEZs.

Table 20: Relation on the number of vessels per phase that operates on other EEZs

	Neigb.EEZs Phase 1	Fleet Phase 1	%	Neigb.EEZs Phase 2	Fleet Phase 2	%
ARGENTINA	130	350	37.1	1	74	1.4
THAILAND	16	865	1.8	-	2990	-
NORWAY	149	305	48.9	5	130	3.8
SINGAPORE	0	1 Reefer	0.0	0	3	0.0
MAURITANIA	242	242	100.0	102	102	100.0
VANUATU	40	90	44.4	2	-	-
NEW ZEALAND	1	99	1.0	0	91	0.0
EUROPEAN UNION	643	3428	18.8	89	3928	2.3
GREECE	0	178	0	0	242	0
FRANCE	-	371	-	-	238	-
TRINIDAD & TOBAGO	0	17	0	0	51	0
SLOVENIA	0	0	0	0	0	0
ANGOLA	57	158	36	0	61	0
SUDAN	0	0	0	0	0	0
DJIBOUTI	0	0	0	0	0	0

Vessels of Phase 1 fishing on neighboring countries are generally authorized for High Seas and operate by bilateral agreements on other EEZs, being present on both assessments. This means that both conditions are complementary and linked.

In summary, fishing vessels that operates on the High Seas are generally those belonging to phase 1 exclusively and therefore over 24 meters of length overall. When for particular cases EEZs are not established till 200 nm, or straddling stocks are present in coastal areas, some vessels of phase 2 also operate in High Seas targeting them (mostly the case of the tuna and tuna-like species fishery). Fishing activities in Neighboring EEZs follows a similar trend. Fishing vessels over 24 meters, access in larger proportions, although the proximity of the neighbor fishing ground can attract other smaller vessels from phase 2 increasing slightly the proportion of its vessels in relation with those that participated in High Seas.

11. Analysis of IUU Lists and Purple Notices

As starting point, the IUU vessels lists and the INTERPOL Purple Notices studied shows a total amount of 264 vessels involved in IUU fishing activities as subject of study. Many of these vessels, are listed with important data gaps referring to the type of vessel, as well as referring to dimensional data fields like length or tonnage, flag data fields, etc. (Figure 22). The reasons of this missing information can maybe correspond to the fact that most of this vessels come from sighting reports and probably when they were reported to the different RFMO's Secretariats didn't included dimensional characteristics or simply those data fields weren't displayed for not being required on the lists above-mentioned. Due that the majority of those vessels are not recorded in any RFMO, change name and flag frequently and belong to open registers where their information is not public, finding the missing data fields is complex. As consequence, the absence of many data fields will reduce the number of vessels involve in the analysis and its representativeness.

From the flag perspective, it is noteworthy and striking the large proportion of reflagging conducted by the vessels listed. Usually, the original flag state corresponds with the owner's State before it starts flag hopping from one open register to the other, generally in order to continue operating after closures, capacity reduction measures, no more licensing or authorizations, etc. Among the most common flags open registers noticed, it can be derived that 41% of the non fishing vessels have been reflagged on Panama. In the case of fishing vessels, the most common flag state used correspond to Belize, representing the 44% followed by Panama 24%.

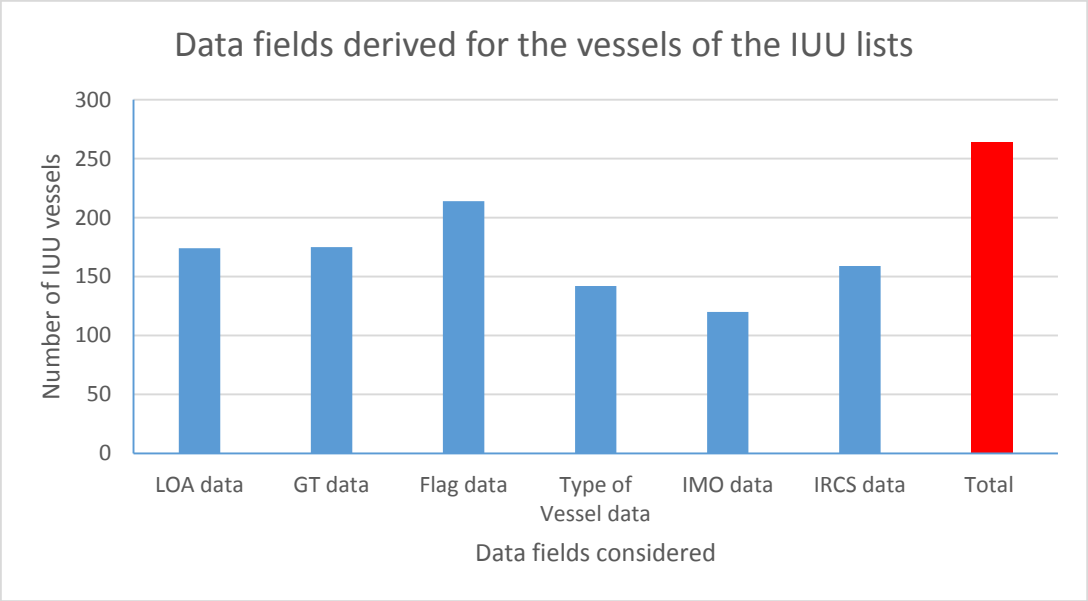

Figure 24: extension of data fields provided

The vessels included in the IUU lists, are not exclusively fishing vessels, other non fishing vessels as fish carriers, reefers, fish factories, supply vessels, etc., can be included for supporting IUU fishing activities, reason why they are also included on the

Global Record. From Figure 23, can be observe that 19 vessels are classified as non fishing vessels and for other 46 vessels there is no data type field, leaving a total figure of 199 fishing vessels recognized. Of those fishing vessels the most common group type represented are the longliners (LL), followed by the trawlers (OTB) and at last, the purse seiners (PS).

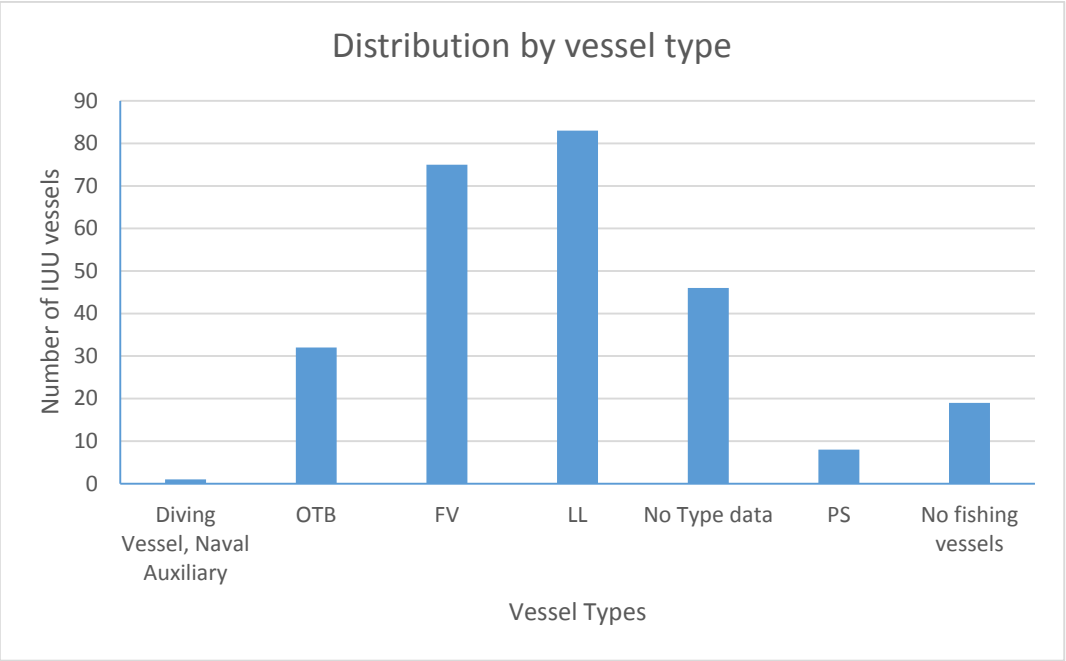

Figure 25: Vessel type distribution on IUU Lists

For the purpose of this study, as the minimum requirements are based on the two dimensional parameters of length overall and tonnage, those will be the most relevant data fields evaluated. Data fields, just present in 176 of the vessels listed (Figure 22). A first glance to this data shows that all the vessels listed have overall lengths above 19 meters with tonnages over 54 GT, setting as a minimum boundary vessels belonging to phase 2 of the Global Record. Plotting the lengths and tonnages by number of vessels (Figure 24), reveal that 48 (30 %) belong to phase 2 and 120 (70%) to phase 1. The most frequent ranges of lengths observed indicate a maximum over 23 meters, and high numbers of vessels involved under the ranges that goes from 20 -29 m that correspond to phases 1 and 2, and from 47 – 63 m which is only phase 1.

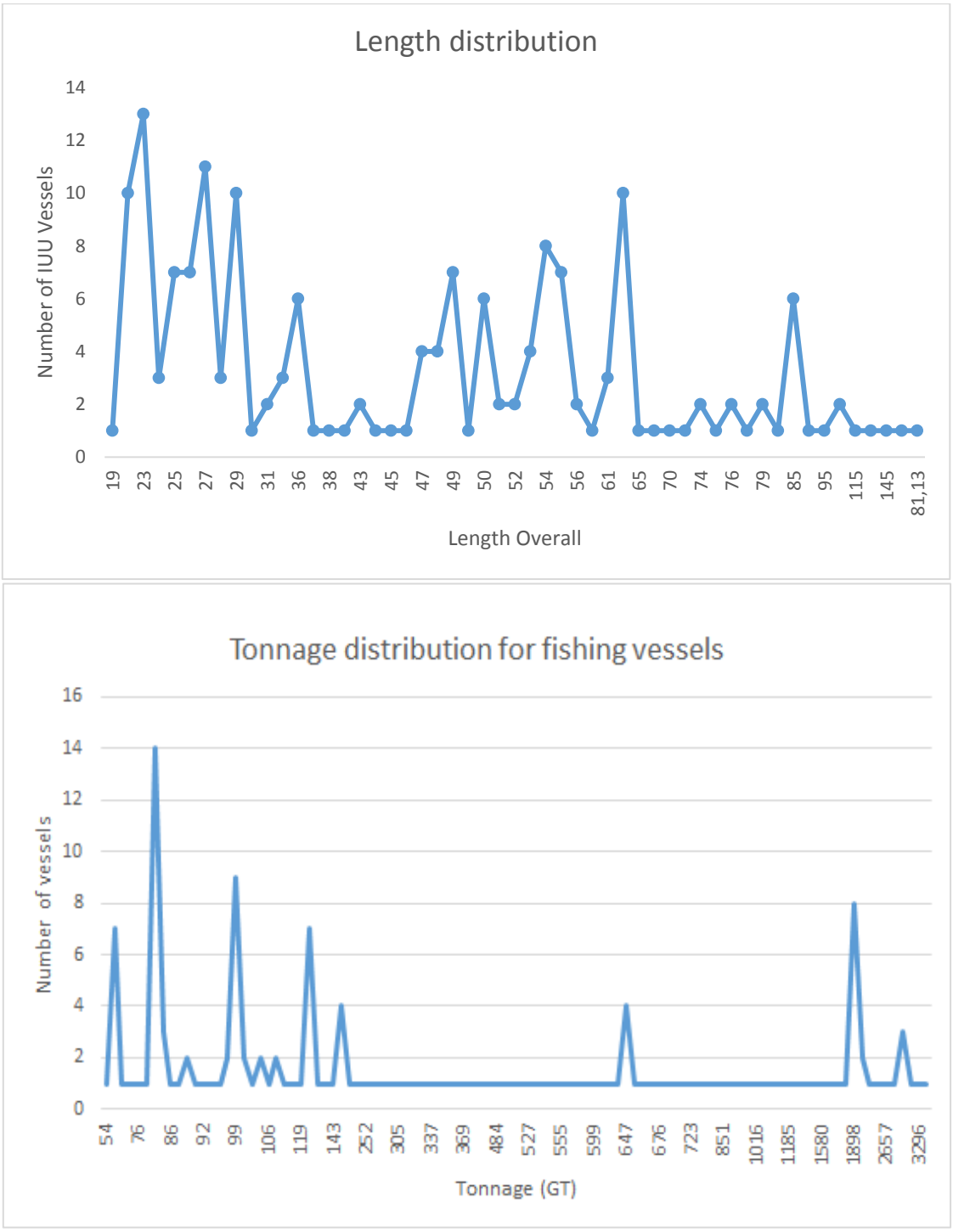

Figure 26: length and tonnage distribution on IUU Lists

Tonnage distribution have a similar pattern, presenting a wide distribution of tonnages with a maximum on 79 GT (14 vessels) and other frequent tonnages with values of 55 GTS, 99 GT, 195 GT for fishing vessels.

Regarding the relation between the length or tonnage of the vessel and its type (Figure 26), it is observed that generally longliners (LL), are the smaller type of vessels involved, follow by purse seiners (SP) and trawlers (TO) who are the biggest. The most frequent vessel sighted performing or supporting IUU fishing activities are the

longliners of approximately 80 GTs (23 meters) followed by other longliners. The maximums displayed at the end of each vessel type, shows those vessels who doesn't have tonnage or length data available.

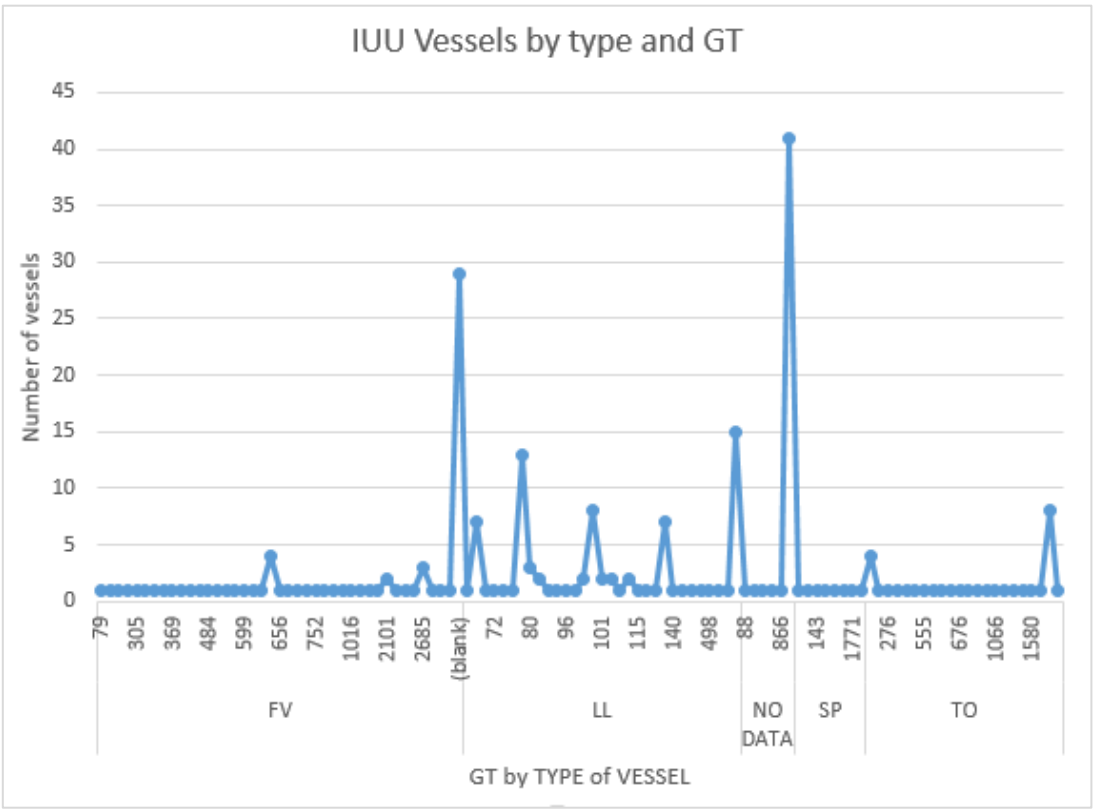

Figure 27: distribution by type of vessel and tonnage

From the results, agreeing with the analysis realized in 2010 (MRAG, 2010), strongly emerges that in those areas of the conventions pertaining to the nine main RFMOs studied, a large majority of vessels involved in IUU fishing practices are longliners (67% only considering fishing vessels with the gear specified) around 23 meters of length overall. Due that most of this RFMOs deal with tuna and tuna-like species management and longliners are the main gear used targeting this species, the results on vessel type are not conclusive. Nevertheless, lengths overall and tonnages might show general patterns of behavior, setting minimum figures, mainly on High Seas where those RFMOs operate, of over 19 meters of length overall and 53 GT (phase 1 and 2 of the Global Record).

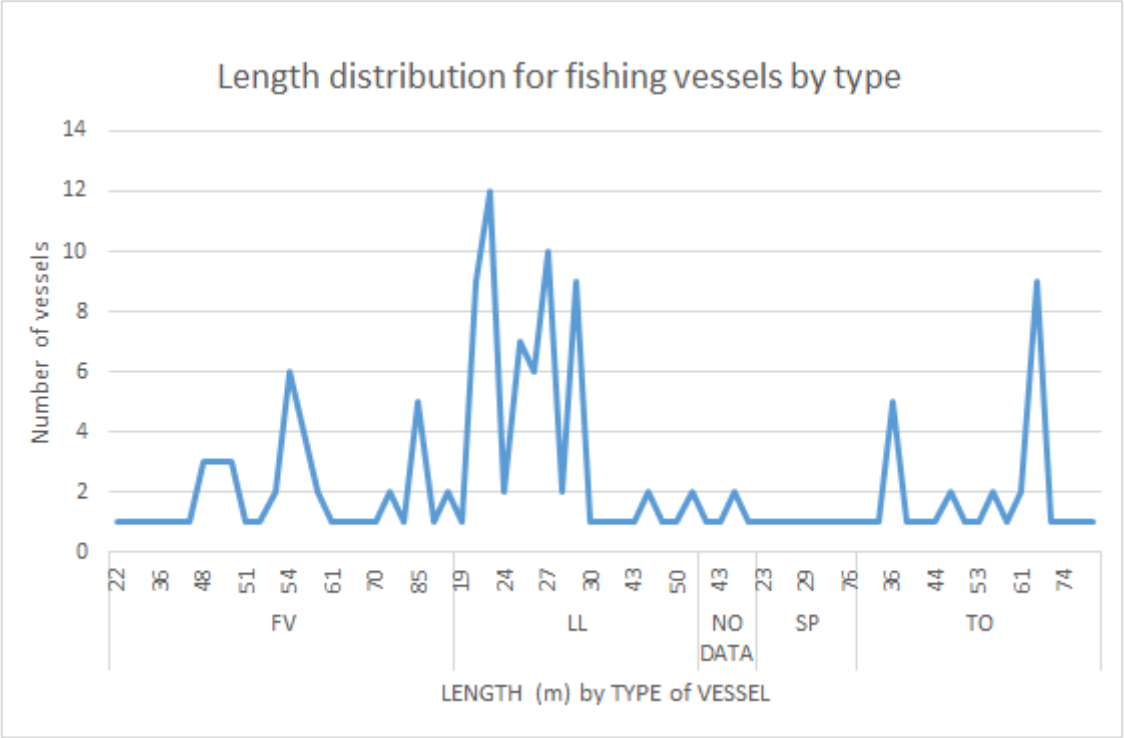

Figure 28: distribution by type of vessel and length

V. CONCLUSIONS

i. The results obtained during the study unveil important and numerous gaps related with the current global number of fishing vessels that strongly undermine transparency. Several circumstances as; the bad or non reporting of vessel's numbers; the lack of harmonization of databases; duplication of records; and the difficulties of maintaining the databases up-to-date amongst others, have caused the main inconvenient for the data compilation. Reliability and representativeness of the data should be improve.

ii. However, from the global fleet analysis, some conclusions can be extracted in order to state valuable recommendations to further continue the study and set general lines that will enhance the feasibility of the Global Record project. In this sense, the analysis of the global fishing fleet arises that world fishing fleet is strongly based on small scale fisheries entailing small size vessels under 12 meters that operates in national waters (91.4% in fishing vessel numbers). Varying slightly between regions phase 3 contributes with the 5.8% to the global fleet, while phase 2 and 1 reaches the 1.4%. Asian region compiles the biggest world fishing fleet proportion with up to 78% in vessel numbers, becoming their vessel characteristics of high relevance at the time of including more or less vessels through setting a specific minimum boundary length. At a second level, Africa although is the second after Asia in terms of vessel numbers is the less industrialized region, possessing a large small size fishing fleet under 18 meters (98.9%).

iii. Scenario 1: Length overall set at 12 meters. Taken into account the data hereby presented, fixing a minimum boundary limit based in an overall length of 12 meters for the Global Record, it will approximately include into the information system a 8.6% of the global existing fleet. Considering the estimated figure or 4,6 millions of world's number of vessels set by the FAO (SOFIA report 2016), 395.600 vessels should be submitted. In terms of regional representation it will be distributed with 9.1% of the fleet corresponding to Asia, 3.8% Africa, 18.1% EU, 3.5% Central America, 10% South America and 10.2% Oceania.

iv. Scenario 2: Length overall set at 18 meters. It will include the 7.2% of the global fleet what comprised around 331,200 fishing vessels. It is important to remark the effects related with each region while fixing a determined minimum length overall boundary. In case of selecting 18 meters as inferior limit, it would comprised the 1.1% of the African fleet, 8.8% of European fleet, 2.4% Central American fleet, 8.7% South American fleet and 10,2% possibly of the Oceanian fleet. This will mean that some regions will need to participate more actively than others and in function of their political willingness or register development, the feasibility of the Global Record will rely on them.

v. Regarding the activity on High Seas and other EEZs, the fishing fleet that operates on the High Seas or distant EEZs, is mainly constituted by big trawlers, purse seiners and longliners belonging to phase 1 exclusively and therefore over

24 meters of length overall. Nevertheless, in those cases where EEZs that are not established till 200 nm, or coastal States possess straddling stocks vessels of phase 2 commonly involved on tuna targetted fisheries could be also involved. Fishing activities in Neighboring EEZs due to the proximity of the neighbor fishing ground can attract other smaller vessels from phase 2 increasing slightly the proportion of its vessels in relation with those that participated in High Seas. Hence, from an international perspective, setting a minimum overall length at the inferior limit of phase 2, in 18 meters, might cover extensively all the fishing vessels involved.

vi. At last, IUU vessel records of the main RFMOs, indicate a common trend. Vessels sighted and listed for realizing or supporting IUU fishing activities in their areas of regulation belong to phase 1 basically. Furthermore, minimum length overall listed corresponds to a vessel with 19 meters and 53 GT (phase 2), strengthening the believe that a 18 meters length overall minimum boundary would might be an adequate approach.

VI. RECOMMENDATIONS

This preliminary feasibility study allowed to identify data gaps and weak points to be solve for further studies. Aspects improvable, could comprise the segregated collection of data distinguishing from marine and inland fisheries, as well as from aquaculture in FAO questionnaires. The assessment of relevant fleets belonging to countries owing the largest world fishing fleets, as the case of the Asian region. The analysis of fishing agreements, as the Regional Bodies show just a partial image of High Seas fishing activity that do not take into account vessels engaged on multilateral, bilateral and private agreements, as well as joint ventures. Thus, for enhancing comprehension of these important aspects engaging fishing on other EEZs, and complete the picture, future studies could entailed field visits or the use of other focused surveys to the countries, in which participation rates need to be increased.

Other approaches that could clarified the feasibility of the expansion, must consider the IMO Numbering scheme capacity to provide unique and unequivocal IMO numbers to all the vessels targeted by the Global Record. As essential data field, the IMO number provision, can become a limiting stage and undermine the speed up of the process, provoking the lost of interest of Flag States willing to participate.

The state of development of the different countries registers, just as their adaptability to connect with the Global Record, can be an aspect of the feasibility study worthy to develop along with weaknesses analysis for capacity development activities and technical support.

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ANNEX I

FF1 and FF2 questionnaires of the FAO

ORGANIZACIÓN DE LAS NACIONES UNIDAS PARA LA ALIMENTACIÓN Y LA AGRICULTURA

SUBDIVISIÓN DE ESTADÍSTICAS Y INFORMACIÓN DE PESCA Y ACUICULTURA

INSTRUCCIONES PARA RELLENAR LOS FORMULARIOS FISHSTAT FF 1 Y 2

FISHSTAT FF1
Embarcaciones con cubierta

FISHSTAT FF2
Embarcaciones sin cubierta

1. Los datos deben registrar el número total de embarcaciones de pesca nacionales, como sigue:

PARA EMBARCACIONES CON CUBIERTA

I) Eslora total (E.T.)
II) TB (Tonelaje bruto)
III) Potencia
IV) Tipo de embarcación

PARA EMBARCACIONES SIN CUBIERTA

I) Eslora total (E.T.)
II) Con motor / Sin motor
III) Tipo de embarcacion

2. Los datos deberán abarcar toda la flota de pesca Industrial y artesanal, pero excluir los barcos de apoyo no pesqueros, tales como transportadores de pescado, buques nodriza, buques de investigación, etc.
3. Se utiliza el pabellón del barco para asignarle su nacionalidad.
4. Los datos deben referirse, de ser posible, al 31 de diciembre del año sobre el que se informa.
5. Sírvase añadir otra información pertinente disponible en sus estadísticas, como la edad media de la flota, o cualquier información fácilmente disponible.

Se ruega devolver los formularios lo antes posible, pero no más tarde del 31 de agosto de 2016 a:

Estadístico superior de pesca
Subdivisión de Estadísticas y Información
Departamento de Pesca y Acuicultura, FAO
00153 Roma, Italia

Fax: + 39 06 57052476
E-mail: Fish-Statistics-e-Forms@fao.org

FLOTA PESQUERA – **NÚMERO** DE EMBARCACIONES **CON CUBIERTA** / **TONELAJE** TOTAL Y **POTENCIA** TOTAL POR **E.T.** (ESLORA TOTAL) Y **TIPO**

FISHSTAT FF-1

País: ..... **Año: 2015**

E.T. (Metros)	Código N = Número [1] TB = Tonelaje bruto [2] P = Potencia Kw [3]		Total	TIPO DE EMBARCACIÓN									
				Arrastreros 01	Cerqueros con jareta 02	Otros cerqueros 03	Emb. con redes de enmalle 04	Emb. con trampas 05	Palangreros 06	Otras emb. con línea 07	Emb. Polivalentes 08	Rastreros 9.1	Otras emb. de pesca 9.0
Hasta 11.9	100	N											
		TB											
		P											
12 - 17.9	110	N											
		TB											
		P											
18 - 23.9	120	N											
		TB											
		P											
24 - 29.9	130	N											
		TB											
		P											
30 - 35.9	140	N											
		TB											
		P											
36 - 44.9	150	N											
		TB											
		P											
45 - 59.9	160	N											
		TB											
		P											
60 - 74.9	170	N											
		TB											
		P											
75 o más	180	N											
		TB											
		P											
TOTAL		N											
		TB											
		P											

[1] Número total de barcos [2] Tonelaje Bruto Total. (Indíquese si es diferente de T.B., por ejemplo TRB) [3] potencia total. (Indíquese si es diferente de KW, p.e. HP, CV, etc.)

	FLOTA PESQUERA – **NÚMERO** DE EMBARCACIONES **SIN CUBIERTA**, **CON MOTOR** Y **SIN MOTOR**, POR **E.T.** (ESLORA TOTAL) Y **TIPO**	**FISHSTAT FF-2**

País: ..... **Año: 2015**

			TIPO DE EMBARCACIÓN									
E.T. **(Metros)**	**Código** **P** = n°. Con motor **NP** = n°. Sin motor	**Total**	**Arrastreros** 01	**Cerqueros con jareta** 02	**Otros cerqueros** 03	**Emb. con redes de enmalle** 04	**Emb. con trampas** 05	**Palangreros** 06	**Otras emb. con línea** 07	**Emb. Polivalentes** 08	**Rastreros** 9.1	**Otras Emb. de pesca** 9.0
Hasta 5.9	200 **P**											
	NP											
6 - 11.9	210 **P**											
	NP											
12 - 17.9	220 **P**											
	NP											
18 - 23.9	230 **P**											
	NP											
24 - 29.9	240 **P**											
	NP											
30 o más	250 **P**											
	NP											
TOTAL	**P**											
	NP											

ANNEX II:

SURVEY FOR THE FEASIBILITY STUDY ON PHASES 2 AND 3 OF THE GLOBAL RECORD OF FISHING VESSELS, REFRIGERATED TRANSPORT VESSELS AND SUPPLY VESSELS

Survey 1: Fleet data (1st June 2017)

In July 2014, COFI 31 endorsed the use of the IMO number as the Global Record's unique vessel identifier for Phase 1, whilst expansion to Phases 2 and 3 could be addressed through a targeted feasibility study. This study, was subsequently requested by the 1st and 2nd meetings of the Global Record Working Groups.
Consequently, with the aim to initiate the feasibility study, we hereby present this preliminary brief survey (of less than 10 min) in order to collect and complete the essential information needed.
We highly appreciates your collaboration and contribution and thanks you in advance for your contribution.

Note: to fill up this questionnaire, the following should be considered:

- Only fishing vessels from MARINE commercial fisheries, NOT inland fisheries or aquaculture.
- Phase 1: ≥ 24m Overall Lenght (LOA) (or ≥ 100GT/GRT)
- Phase 2: ≥ 18m but < 24m LOA (or ≥ 50 GT/GRT but < 100 GT/GRT)
- Phase 3: ≥ 12m but < 18m LOA (or ≥10 GT/GRT but < 50 GT/GRT)

Name of the country submitting the questionnaire:

2. Total number of fishing vessels in the country:

(Phases are specified of the top page note text)

For Phase 1:
For Phase 2:
For Phase 3:
<12 m:

3. Is there a minimum overall length required for registering fishing vessels in the National Registry?

If yes, indicate also the length overall established.

4. Number of fishing vessels with IMO number assigned in your country:

Phase 1:

Phase 2:

Phase 3:

<12 m

5. Is there a minimum overall length required for vessels to obtain an IMO Number?

if yes, kindly indicate also the length overall established

6. Number of fishing vessels authorized to fish in the national EEZ:

(phases are specified on the top page note text)

For Phase 1

For Phase 2

For Phase 3

< 12 m

7. Number of vessels authorized to fish in neighboring EEZs:

For Phase 1

For Phase 2

For Phase 3

<12 m

8. Number of vessels authorized to fish in the High Seas:

(Parts of the sea that are not included in the exclusive economic zone, in the territorial sea or in the internal waters of a State, or in the archipelagic waters of an archipelagic State)

For Phase 1

For Phase 2

For Phase 3 

<12 m 

Send for submission to: FI-Global-Record@fao.org

ANNEX III

Sources of data used for the study

AFRICA	Year	<12m	Phase 3	Phase 2	Phase 1	TOTAL/PAIS	SOURCE
Algeria	2011	3000	1227	99		**4326**	**FAO**
Angola	2017	9112	30	61	158	**9361**	**FAO**
Benin	2012	52537	742	2	3	**3816**	**FAO**
							FAO
Cameroon	2009	11247	1424	7	53	**13489**	**FAO**
Cape Verde	2011	1254	48	28		**1330**	**FAO**
Comoros	2012	5755				**5755**	**FAO**
Congo, D. Rep.of the	2006						**Not Considered**
Congo, Republic of	2012	14608	44	24	26	**14702**	**FAO**
Côte d'Ivoire	2012	8812	677	1004	32	**10525**	**FAO**
							FAO
Djibouti	2017	250	20			**270**	**FAO**
Egypt	2012	23799	2441			**32049**	**FAO**
Equatorial Guinea	2012	359	113		1	**473**	**FAO**
Eritrea	2012	127	41	14	31	**213**	**FAO**
Gabon	2008	1000	484	18	44	**1546**	**FAO**
Gambia	2008	1506	200	6	18	**1730**	**FAO**
							FAO
Ghana						**29023**	**FAO**
Guinea	2012	4700	1325		3	**6028**	**FAO**
Guinea-Bissau	2012	2020			1	**2020**	**FAO**
Kenya	2012	19268	588	4	8	**19868**	**FAO**
							FAO
Liberia	2008	1280		23	14	**1317**	**FAO**
Libya	2008	2713	1325	163	161	**4362**	**FAO**
Madagascar	2012	28820	18	24	100	**28994**	**FAO**
Mali	2012	56230					**Not Considered**
Mauritania	**2017**	**10000**	**36**	**102**	**242**	**10000**	**QUESTIONNAIRE**
Mauritius	2011	2060	13	1	7	**2081**	**FAO**
Morocco	2010	17139	510	1180	293	**19532**	**FAO**
Mozambique	2012	46080	211	28	95	**46502**	**FAO**

Namibia						**199**	**FAO**
Nigeria						**77239**	**FAO**
Réunion	2012	240	18	8	5	**271**	**FAO**
St Helena	2012	22				**22**	**FAO**
Rwanda	2005	1532				**1532**	**FAO**
Sao Tome and Principe	2009	2419	24			**2473**	**FAO**
Senegal	2011	8738	11	16	86	**11295**	**FAO**
Seychelles	2011	181	10	1	32	**224**	**FAO**
Sierra Leone						**9516**	**FAO**
Somalia	2017	0	0	0	0	**0**	**FAO**
South Africa						**1780**	**FAO**
Sudan (Mar Rojo)	2009	8484				**8484**	**FAO**
Tanzania, United Republic of	2012	56985			36	**57375**	**FAO**
Togo	2012	236	157	8		**401**	**FAO**
Tunisia	2012	10660	681	373	237	**11981**	**FAO**
Uganda	2011	42695	592	3	3	**43293**	**FAO**
		455868	**13010**	**3197**	**1689**	**495397**	

ASIA	Year	<12m	Phase 3	Phase 2	Phase 1	TOTAL/PAIS	
Azerbaijan	2012	861			14	875	FAO
Bahrain	2012	2178	343			2521	FAO
Bangladesh	2012	50892	10	28	166	67406	FAO
Brunei Darussalam	2012	2295	12	22	4	2333	SEAFDEC + FAO
Cambodia						108145	FAO
China	2012					1065319	FAO
Georgia							No data
India						233286	FAO
Indonesia	2014	610655	34117	3241	3953	651966	SEAFDEC + FAO
Iran (Islamic Rep.of)	2012	8760	2860	610	45	12275	FAO
Iraq	2012	46	21	174	37	278	FAO
Israel							No data
Japan	2012					85426	FAO
Jordan	2011	58				58	FAO
Kazakhstan	2010			10	15	25	FAO
Korea, D.P. Rep. of						3036	FAO
Korea, Republic of	2012	2095	4714	1365	1502	71287	FAO
Kuwait	2012	697		151	13	861	FAO
Lebanon	2012	2227	39			2745	FAO
Maldives	2009	779	1329			2108	FAO
Myanmar	2014	26354	1075	699	830	28958	SEAFDEC + FAO
Oman	2012	19353	401	254	37	22443	FAO
Pakistan	2012	18300	10020		7460	35780	FAO
Philippines						473998	FAO
Qatar	2011	62	317	118		497	FAO
Russian Federation							No data
Saudi Arabia	2010	10145	70	943	37	11195	FAO
Singapore	2014	154	1	3	1 reefer	158	SEAFDEC + QUESTIONNAIRE
Sri Lanka	2012	49610	1520			53110	FAO
Syrian Arab Republic	2010	1732	59	8	7	1806	FAO
Taiwan (China)	2012	6954	2789	2196	1739	22771	FAO
Turkey	2007	18840				16764	FAO
Thailand	2008	14425	7522	2990	865	23556	SEAFDEC + FAO
Turkmenistan							No data
United Arab Emirates							No data
Viet Nam						129376	FAO
Yemen	2012	22000	1301	4	8	23582	FAO
Malaysia	2014	48076	6908	2988	0	57972	SEAFDEC + FAO
		917548	75428	15804	16732	3211916	

OCEANIA	Year	<12m	Phase 3	Phase 2	Phase 1	TOTAL/PAIS

Australia							**No data**
Cook Islands	2007	3	4	8	23	**38**	**FAO**
Fiji, Republic of	2011-12	2750	5	31	36	**2822**	**FAO**
French Polynesia	2012	3927	30	31	3	**3991**	**FAO**
Guam	2012		235		36	**271**	**FAO**
Kiribati							**No data**
Marshall Islands							**No data**
Micronesia, Federated States of							**No data**
New Caledonia	2012	227	1	13	6	**247**	**FAO**
Nauru	2012	78				**78**	**FAO**
New Zealand	2012-2017	**726**	**418**	**91**	**99**	**1334**	**QUESTIONNAIRE**
Niue							**No data**
Palau							**No data**
Papua New Guinea	2012	5	37	51	570	**663**	**FAO**
Samoa							**No data**
Solomon Islands							**No data**
Timor-Leste							**No data**
Tokelau							**No data**
Tonga	2012	1108	6	17	12	**1108**	**FAO**
Tuvalu	2006	215				**215**	**FAO**
Vanuatu	2012	**100**	**3**		**90**	**192**	**QUESTIONNAIRE**
		9139	**739**	**242**	**875**	**10959**	

EUROPE	Year	<12m	Phase 3	Phase 2	Phase 1	TOTAL/PAIS

Albania	2012	324	104	90	42	562	FAO
Belgium	2012					1	FAO
Bulgaria	2012					2271	FAO
Channel Islands	2012	160	2	1		163	FAO
Croatia	2012					1891	FAO
Cyprus	2012	1038	24	5	8	1075	FAO
Denmark	2012					2569	FAO
Estonia	2012					1300	FAO
Faroe Islands							No data
Finland	2012					3167	FAO
France	2010					4426	FAO
Germany	2012					1491	FAO
Greece	2012					15090	FAO
Iceland	2017	1156	269	50	172	1647	FAO
Ireland	2012					2193	FAO
Italy	2012					8972	FAO
Latvia	2012					634	FAO
Lithuania	2012					107	FAO
Malta	2012					961	FAO
Monaco		0	0	0	0	0	No data
Montenegro	2012		17			2555	FAO
Netherlands	2012					830	FAO
Norway	2012		666	130	305	5939	QUESTIONNAIRE
Poland	2012					603	FAO
Portugal	2012					7498	FAO
Romania	2012					190	FAO
Slovenia	2012					158	FAO
Spain	2012					9632	FAO
Sweden	2012					1204	FAO
Ukraine							No data
United Kingdom	2012					6225	FAO
		2678	1082	276	527	83354	

NORTHAMERICA	Year	<12m	Phase 3	Phase 2	Phase 1	TOTAL/PAIS	
Canada						18136	FAO

Greenland	2007					**297**	**FAO**
United States of America						**75695**	**FAO**
		0	0	0	0	**93831**	

CENTRAL AMERICA	Year	<12m	Phase 3	Phase 2	Phase 1	TOTAL/PAIS	
Antigua and Barbuda	2011	100	4			**267**	**FAO**
Bahamas	2012	1063	148	64	21	**1296**	**FAO**
Barbados	2010	586	103	3		**692**	**FAO**
Belize	2012	717				**717**	**FAO**
Costa Rica							**No data**
Cuba	2012	146	398	65	10	**619**	**FAO**
Dominica	2012	410	9			**419**	**FAO**
Dominican Republic							**No data**
El Salvador	2011	13604	46	113	5	**1604**	**FAO**
Grenada	2011	752	64			**869**	**FAO**
Guatemala	2012	6500	27	25	4	**6557**	**FAO**
Haiti							**No data**
Honduras	2012	17486	80	95	48	**17712**	**FAO**
Islas Malvinas	2012				20	**20**	**FAO**
Jamaica	2012	4081	24	2		**4107**	**FAO**
Mexico	2012	68648	617	1931	458	**75741**	**FAO**
Nicaragua	2012	6482	4	84	36	**6606**	**FAO**
Panama	2012	10890		388	4	**11282**	**FAO**
Saint Kitts and Nevis	2012	357	5			**362**	**FAO**
Saint Lucia	2012	693	6	1		**700**	**FAO**
Saint Vin-cent/Grenadines	2011	731	8		3	**742**	**FAO**
Trinidad and Tobago	2017	2342	36	51	17	**2446**	**FAO**
Anguilla	2012	102	4			**106**	**FAO**
Bermuda	2012	190	30			**220**	**FAO**
Bonaire/S.eustatius/Saba	2012	116				**116**	**FAO**
Montserrat	2012					**229**	**FAO**
Guadeloupe	2012	990		1		**991**	**FAO**
Martinique	2012	1149	3	5		**1157**	**FAO**
Puerto Rico	2010	669	1			**670**	**FAO**
Turks and Caicos Is.	2010	138				**138**	**FAO**
US Virgin Islands	2011	274	4			**278**	**FAO**
		139216	1621	2828	626	136663	

SOUTHAMERICA	Year	<12m	Phase 3	Phase 2	Phase 1	TOTAL/PAIS

Argentina			**140**	**74**	**350**	**911**	**QUESTIONNAIRE**
Brazil							**No data**
Chile	2012	11283	494	144	254	**9107**	
Colombia							**No data**
Ecuador	2011	35410	181	135	68	**29977**	
Guyana	2012	321	162	115		**598**	
French Guiana	2012	134	4	26	1	**165**	
Peru	2009	3401	792	248	914	**5601**	
Suriname	2009	385	397	65	17	**864**	
Uruguay	2012	662		27	41	**730**	
Venezuela, Bolivarian Republic of	2012	17432	2746	154	130	**20722**	
		69028	**4916**	**988**	**1775**	**68675**	

	Phase 4	Phase 3	Phase 2	Phase 1	
Total	**1660686**	**105025**	**26207**	**25615**	**4101092**

ANNEX IV

UE Fleet Register and FAO Database merged

EUROPE	< 12m	Phase 3	Phase 2	Phase 1	Type	Source
Albania	324	104	90	42	Non EU	FAO
Belgium		5	20	47	EU	EU Fleet Register
Bulgaria	1806	76	17	11	EU	EU Fleet Register
Channel Islands	160	2	1		Other registries	FAO
Croatia	6785	470	97	142	EU	EU Fleet Register
Cyprus	757	30	3	8	EU	EU Fleet Register
Denmark	1779	291	84	100	EU	EU Fleet Register
Estonia	1507	19	1	29	EU	EU Fleet Register
Finland	2977	103	11	25	EU	EU Fleet Register
France	5281	828	241	367	EU	EU Fleet Register
Germany	1034	214	78	66	EU	EU Fleet Register
Greece	14227	517	244	178	EU	EU Fleet Register
Iceland	717	159	35	174	Non EU	FAO
Ireland	1689	212	34	174	EU	EU Fleet Register
Italy	8592	2538	781	383	EU	EU Fleet Register
Latvia	608	13	1	56	EU	EU Fleet Register
Lithuania	95	7	1	40	EU	EU Fleet Register
Malta	823	41	27	15	EU	EU Fleet Register
Montenegro		17			Non EU	FAO
Netherlands	346	69	168	265	EU	EU Fleet Register
Norway		**666**	**130**	**305**	Non EU	FAO
Poland	593	139	51	58	EU	EU Fleet Register
Portugal	7110	502	157	205	EU	EU Fleet Register
Romania	119	14	2	3	EU	EU Fleet Register
Slovenia	157	15	3		EU	EU Fleet Register
Spain	6768	1113	648	772	EU	EU Fleet Register
Sweden	958	212	34	54	EU	EU Fleet Regis-

						ter
United Kingdom	4675	935	189	399	EU	EU Fleet Register
TOTAL	**69887**	**9311**	**3148**	**3918**	**86264**	

Universitat d'Alacant
Universidad de Alicante

GOBIERNO DE ESPAÑA
MINISTERIO DE AGRICULTURA, ALIMENTACIÓN Y MEDIO AMBIENTE

CIHEAM

El Máster Internacional en GESTIÓN PESQUERA SOSTENIBLE está organizado conjuntamente por la Universidad de Alicante (UA), el Ministerio de Agricultura, Alimentación y Medio Ambiente (MAGRAMA), a través de la Secretaría General de Pesca (SGP), y el Centro Internacional de Altos Estudios Agronómicos Mediterráneos (CIHEAM), a través del Instituto Agronómico Mediterráneo de Zaragoza (IAMZ).

El Máster se desarrolla a tiempo completo en dos años académicos. Tras completar el primer año (programa basado en clases lectivas, prácticas, trabajos tutorados, seminarios abiertos y visitas técnicas), durante la segunda parte los participantes dedican 10 meses a la iniciación a la investigación o a la actividad profesional realizando un trabajo de investigación original a través de la elaboración de la Tesis Master of Science. El presente manuscrito es el resultado de uno de estos trabajos y ha sido aprobado en lectura pública ante un jurado de calificación.

The International Master in SUSTAINABLE FISHERIES MANAGEMENT is jointly organized by the University of Alicante (UA), the Spanish Ministry of Agriculture, Food and Environment (MAGRAMA), through the General Secretariat of Fisheries (SGP), and the International Centre for Advanced Mediterranean Agronomic Studies (CIHEAM), through the Mediterranean Agronomic Institute of Zaragoza (IAMZ),

The Master is developed over two academic years. Upon completion of the first year (a programme based on lectures, practicals, supervised work, seminars and technical visits), during the second part the participants devote a period of 10 months to initiation to research or to professional activities conducting an original research work through the elaboration of the Master Thesis. The present manuscript is the result of one of these works and has been defended before an examination board.